NATIONAL ASSOCIATION FOR THE STUDY AND PREVENTION OF TUBERCULOSIS

SIXTH ANNUAL MEETING
WASHINGTON, D. C.

NATIONAL ASSOCIATION
FOR THE STUDY AND PREVENTION
OF TUBERCULOSIS

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National Association for the Study and Prevention of Tuberculosis

TRANSACTIONS

OF THE

SIXTH ANNUAL MEETING

WASHINGTON, D. C.

May 2d–3d, 1910

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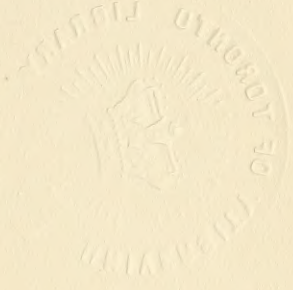

The National Association for the Study and Prevention of Tuberculosis

1909–1910

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105 East 22d Street

NEW YORK

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1910–1911

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GEN. GEORGE M. STERNBERG
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SIXTH ANNUAL MEETING

OF THE

National Association for the Study and Prevention of Tuberculosis

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THE sixth annual meeting of the National Association for the Study and Prevention of Tuberculosis was held at the New Willard Hotel, Washington, D. C., on May 2 and 3, 1910.

The President of the Association, Dr. Edward G. Janeway, occupied the chair at the general meeting held at noon on Monday, May 2d. Following the address of the President and the report of the Executive Secretary in accordance with the regular procedure of the Association the following committee was appointed by the chair to present nominations to fill vacancies on the Board of Directors:—

Dr. Walter R. Steiner, Hartford, Chairman
Dr. Henry M. Bracken, St. Paul
Dr. John S. Fulton, Baltimore
Dr. Charles O. Probst, Columbus
Mr. Frank E. Wing, Chicago

The following Committee on Resolutions was also appointed by the chair:

Mr. Homer Folks, New York, Chairman
Dr. Hermann M. Biggs, New York
Dr. G. Walter Holden, Denver
Dr. John H. Lowman, Cleveland
Gen. George M. Sternberg, Washington

At the regular business meeting of the Association held on the evening of Monday, May 2d, the following gentlemen were unanimously elected Directors of the Association for terms of five years:

Mr. William H. Baldwin, Washington
Mr. William K. Bixby, St. Louis
Mr. Jeffrey R. Brackett, Boston
Dr. Thomas D. Coleman, Augusta, Ga.
Dr. George Dock, St. Louis
Dr. G. Walter Holden, Denver
Dr. Alfred Meyer, New York
Mr. Julius Rosenwald, Chicago
Dr. F. F. Wesbrook, Minneapolis
Mr. Alexander M. Wilson, Philadelphia
Gen. Walter Wyman, Washington

Dr. John L. Dawson, Charleston, S. C., was elected a Director to fill the unexpired term of the late Dr. Charles F. McGahan.

Dr. Elmer E. Heg, Seattle, Wash., was elected a Director to fill the unexpired term of the late Dr. John J. Black.

The following Resolutions were reported favorably by the Committee on Resolutions and were unanimously adopted by the Association:

RELATING TO A FEDERAL DEPARTMENT OF HEALTH

WHEREAS, Hundreds of thousands of human lives are lost annually from tuberculosis and other preventable diseases and

WHEREAS, There is great need of some agency of national scope whose functions shall be the investigation of problems of public health, the dissemination of information relating thereto, and such other duties pertaining to public health as may properly fall within the field of Federal authority, and

WHEREAS, The work of this character which should be undertaken by a national agency is beyond the resources of private effort and should have not only the larger resources, but the dignity and prestige of Federal authority; and

WHEREAS, A bill has been introduced in Congress by Senator Owen and Representative Craeger establishing a Federal Department of Health in which are to be brought together all Federal agencies now dealing with these subjects and by which should be undertaken such new duties relative to public health as the National Government might properly undertake, therefore;

Resolved, That we very heartily indorse the general principle of the Owen-Craeger bill and place on record our conviction that its enactment would be of great service in the prevention of tuberculosis, and of other infectious and preventable diseases.

RELATING TO PROTECTION OF THE MILK SUPPLY

1. *Resolved*, That a thorough, efficient, and continuous official supervision of dairies and herds and of the milk from the dairy to the consumer is of the

first importance in securing a clean and pure milk supply, which is essential to public health.

2. *Resolved*, That the production and handling of milk under such satisfactory sanitary conditions as to insure its complete reliability (*i. e.*, the production of what is known as certified milk) at the present time unfortunately increases its cost to such an extent as to make the use of such milk for general consumption impracticable.

3. *Resolved*, That the efficient pasteurization of the general milk supply (excepting certified milk) when supplementing dairy inspection and applied to milk from inspected dairies and done under official supervision is desirable for the destruction of the ordinary micro-organisms of fermentation and putrefaction and as an additional protection against possible infection by typhoid fever, scarlet fever, diphtheria, tuberculosis, and possibly some other specific infectious diseases.

4. *Resolved*, That pasteurization of milk for sale should not be permitted except under official supervision and on conditions definitely prescribed by competent sanitary authorities; and should not be permitted as a method for the preservation of old or dirty milk.

5. *Resolved*, That milk intended for infant feeding should be considered apart from that intended for general consumption; and should be certified milk when obtainable.

6. *Resolved*, That in the opinion of this Association it has been proven, apparently, that a small percentage of the cases of non-pulmonary human tuberculosis, especially tuberculosis of the lymph-nodes in children under five years of age, is due to infection by tubercle bacilli of bovine origin.

Relating to Nebraska Legislation

Whereas, the State of Nebraska has recently passed a law making it obligatory for hospitals and sanatoria receiving tuberculous patients supported by the public to use treatment by immunization (vaccine therapy); and

Whereas, In the opinion of the members of this Association the present state of knowledge of specific immunization and vaccine therapy in tuberculosis does not justify any State in enacting such legislation; therefore

Resolved, That the National Association for the Study and Prevention of Tuberculosis deplores the above named act of the State Legislature of Nebraska as most unwise, and wholly unjustifiable. Be it further

Resolved, That the Executive Secretary of the Association transmit a copy of these resolutions to the Governor of the State of Nebraska and the Speakers of the Senate and the House of Representatives of that State.

RELATING TO OKLAHOMA PROCEDURE

WHEREAS, The Board of Medical Examiners of the State of Oklahoma refuses to grant licenses to physicians afflicted with tuberculosis; and

WHEREAS, All applicants for such a license must subscribe and swear to a so-called tuberculosis affidavit in which they must not only declare that they are not suffering with tuberculosis in any form but also swear that they have not, within the last three years, lived in the house with or nursed any one suffering from said disease;

WHEREAS, In the opinion of the members of this Association such action of the State Board of Medical Examiners of Oklahoma is not based on sound scientific or economic considerations; and

WHEREAS, It is the conviction of the members of this Association that neither the careful tuberculous physician nor the well trained tuberculous patient pursuing his occupation should be considered a menace to society, be it therefore

Resolved, That this Association deplores the action of the State Board of Medical Examiners of Oklahoma as unjustifiable and prejudicial to the best interests of the community, and

Resolved, That the Executive Secretary transmit a copy of these resolutions to the President and Secretary of the Oklahoma State Board of Medical Examiners and to the Governor of that State.

RELATING TO PLAYGROUNDS

Resolved, That this Association observes with great interest and satisfaction the marked progress throughout the United States and particularly in the District of Columbia during the past year, of the playground movement; and expresses the earnest hope that the National Congress will make adequate appropriations for continuing and extending in the District of Columbia these opportunities for healthful open-air exercise and play.

RELATING TO HOUSING CONDITIONS

Resolved, That we urge upon municipalities a study of housing conditions with special reference to tenement and cheap lodging houses and urge a vigorous effort to improve congested districts, believing that such improvement will decrease the tuberculosis death-rate.

At a meeting of the Board of Directors held on Tuesday afternoon, May 3d, the following officers were elected for the ensuing year:

Dr. William H. Welch, Baltimore, President
Dr. George Dock, St. Louis } Vice-Presidents
Dr. Victor C. Vaughan, Ann Arbor }
Dr. Henry Barton Jacobs, Baltimore, Secretary
Gen. George M. Sternberg, Washington, Treasurer.

The following Directors were elected to serve on the Executive Committee for the ensuing year:

Mr. William H. Baldwin, Washington
Dr. Hermann M. Biggs, New York
Mr. Homer Folks, New York
Dr. John N. Hurty, Indianapolis
Dr. Edward G. Janeway, New York
Dr. George M. Kober, Washington
Dr. Joseph Walsh, Philadelphia

Following the meeting of the Advisory Council on the evening of May 2d, Dr. William Charles White, of Pittsburg, was unanimously elected Chairman of the Advisory Council for the next annual meeting.

REPORT OF THE TREASURER

Dr.

To balance on hand April 30, 1909	$4,268.64	
" membership dues	8,145.00	
" donations	15,121.50	
" sale of photos, models, etc.	35.63	
" sale of lantern slides	126.08	
" sale of Transactions, etc.	274.82	
" payments for local exhibitions	800.00	
" payments for posters	284.00	
" interest	86.13	
" refund on Porto Rico Exhibition	22.80	
" refund of freight	52.80	
		$29,217.40

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By expenditures for		
Rent	$1,485.96	
Salaries	14,491.49	
Executive Office	2,870.69	
Expenses of Bureau of Publicity	2,624.44	
Expenses of Bureau of Construction	1,522.17	
Printing and stationery	1,230.82	
Subscriptions to "Outdoor Life"	334.00	
Furniture and office equipment	420.40	
Expenses of exhibitions	2,695.90	
Reporting of Fifth Annual Meeting	205.83	
Expenses of Annual Meeting	36.00	
Moving picture campaign	99.10	
Storage	162.70	
Poster campaign	406.01	
Refund of checks	90.75	
Auditing accounts	17.00	
Treasurer's expenses	3.00	
		28,696.26
Balance on hand April 30, 1910		$521.14

George M. Sternberg,
Treasurer.

New York, April 30, 1910.

The National Association for the Study and Prevention of Tuberculosis,
105 East 22d Street, New York.

Dear Sirs: In accordance with the request of Dr. Livingston Farrand, Executive Secretary, we have made an audit of the Cash account of the Treasurer of your Association, for the year ended April 30, 1910.

The following is a correct summary of the cash transactions for the year as recorded in the Cash Book:

Balance, May 1, 1909	$4,268.64
Receipts	24,948.76
Total	$29,217.40
Disbursements	28,696.26
Balance, April 30, 1910	$521.14

Yours truly,
(Signed) Haskins & Sells,
Certified Public Accountants.

EXECUTIVE OFFICE ACCOUNT

Dr.

To balance on hand April 30, 1909	$301.96	
" received from Treasurer	2,814.91	
		$3,116.87

Cr.

By expenditures for		
Clerical assistance	$1,730.41	
Postage and telegrams	302.98	
Express, freight, etc.	28.78	
Stationery	148.10	
Furniture	27.25	
Office care	34.91	
Telephone	148.84	
Lantern slides	6.00	
Poster expenses	7.00	
Car-fare and incidentals	2.96	
Traveling expenses	357.81	
Exhibition expenses	4.00	
Circulars, reprints, etc.	24.67	
Storage	46.65	
		2,870.36
Balance on hand April 30, 1910		$246.51

We have examined the accounts of the Treasurer and Executive Secretary and find them correct.

HENRY SEWALL
E. O. OTIS } *Auditing Committee*

Contributors to the funds of the Association for 1909–10 were:

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Mr. F. A. Clark
Mr. W. Bayard Cutting, Jr.
Mr. Charles W. Harkness
Mr. William A. Read
Mrs. J. Malcolm Forbes
Mr. E. C. Benedict
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Mr. Edward Davis

ADDRESS OF THE PRESIDENT

By Edward G. Janeway, M.D.

New York

The subject of tuberculosis, especially to such an audience as this, is one now so generally understood that little is left to say unless one is an original worker on some of the problems which require solution; in view of the fact, moreover, that only a year and a half ago there met here the International Congress on Tuberculosis, at which were presented, and have been published, papers of great value bearing upon this subject, accessible to and in the possession of all the members. You will especially recall those general lectures which are comprised in one of the volumes. This Congress was due in great measure to the energy of one of our late vice-presidents, Dr. Lawrence Flick, who devoted a great deal of thought and time to its successful conduct. We owe great thanks, also, to the chairmen of the different sections, and to the committees on printing and publications, the editorial committee, and the executive committee, and to the Secretary General, who did very valuable work.

At this time it seems to me that a short retrospect might enable us to gain a truer idea of the progress which we have made. When the speaker entered the practice of medicine, not a few accepted the existence of consumption, tuberculosis, and scrofula without a clear comprehension of their relationship, and without an attempt to understand the reason of their existence. The trend of pathologic opinion had been away from the unity of tuberculosis which Bayle and Laënnec had brought to such a point by their masterly studies. Laënnec had seen clearly, and it was the development of the dualistic theory which led many of the profession away from the correct view. At this time Villemin had promulgated his experiments and deductions. These occasioned discussions, controversy, and experiments, which seemed at least to controvert the doctrine which he maintained. At this time we are apt to pass by this remarkable work because of the later demonstration, not alone of its correctness, but also of the discovery of infectious germs, while Villemin shared the fate of many a pioneer. A short survey of what he taught may not be amiss.

Imagination may picture the gain to humanity if the profession had accepted his conclusions, and had also followed such acceptance with appropriate action.

You will recall that in December, 1865, he presented a memoir to the Institute and the Academy of Medicine in Paris upon the "Cause and the Nature of Tuberculosis"; and, also, in 1866, a second memoir. These being published, created for a time other experiments which seemed to permit of another interpretation. In 1868 he published a work entitled "Studies of Tuberculosis"—proof, rational and experimental, of its specific nature and of its inoculability. He attempted different series of inoculations from the tuberculous lesions of man into rabbits, from the tubercles of rabbits into rabbits, which obviated the objection of putrefaction. He also used guinea-pigs, and again tried the inoculation of blood of a tuberculous rabbit into a rabbit; also of sputum from a tuberculous human being into a rabbit, without mentioning all the series of experiments which were used. As a result of these experiments, he in reality proved that the matter of tubercles was in different ways inoculable, and that tubercles developed in the experimented animal. He wrote of the virus and compared it with other infectious diseases,—typhoid, glanders,—and, also, he arrived at the conclusion that the organism did not create the virus, and that the virus was not the lesion, but was the cause of the lesion. These experiments led to others, which seemed to prove the point made by the author, but by making use of other and various materials a confusion arose, so that it seemed that other materials might serve to produce inflammatory or tuberculous-like masses. Cohnheim, however, in 1877, used the anterior chamber of the eye for the inoculation of tubercle, and proved thus the truth of the claim of Villemin, whose name we should hold in honor as a leader in the search after truth, and who lighted the way toward the goal.

It became a necessity that the germ productive of the infection should be discovered, before there was a broad acceptance of the inoculable nature of the disease and of its infectious character. Previously, as you are aware, there had been, through early medical minds, more or less a prevalence of the idea of a contagious character of consumption; but, while a few men had at times made inoculations, no one had presented such a series, nor had presented them in so masterly a way. It is true that a number were persuaded, not alone in the medical profession, but among the laity, of the communicability of consumption, and many of the laity were convinced of this when the medical fraternity were skeptical. At one time it was brought to my attention that certain friends of a phthisical patient entertained the idea that if the sick person could communicate the disease to an animal, he would be

cured. A little inquiry served to show that a shadow for a belief of this nature was in existence, arising out of the facts which seemed to illustrate the contagious or, as we now say, communicable character of the disease. Possibly these were the surviving vestiges of the past, more general, idea.

Then came the epoch-making discovery of Robert Koch, few thinking of the protracted work essential to the complete elucidation and proof of the tubercle bacillus as cause of tuberculosis in all its varied manifestations. This discovery of the germ stopped the contentions regarding a certain histologic structure as essential to tuberculosis. As has been true in many other fields, the spirit is the essential, or, in other words, the results of the irritation are not so important as the irritant which produces them. Gradually or, as we may say, comparatively suddenly, the medical profession became convinced of the truth, and our existence as a body, and of other similar organizations, is due to the fact of Koch's discovery of the germ. As a necessary consequence, it became recognized that, the disease being due to a communicable organism, our duty as a civilized community was to organize a very decided opposition to the ravages of the pest. Naturally, as you will all recall, many were the methods which were tried to destroy the germs within the body without destruction of the body; later came the present position, to fortify the body and intensify its defensive force, and thus enable the system to deal effectively with the foreign invaders. Much laborious work has been done along the lines which these few words bring to thought. Many members of this Association have labored earnestly, both in the laboratory, with culture tubes, with the microscope, and by experimentation, while others have given much thought to the formation of associations, of sanatoria, of hospitals and other institutions for the proper care of those who have been invalided by this foe.

The question, "By what means could society deal with the disease?" has received different answers. The most important thought in this relation is connected with the great value of accurate statistics, and at this juncture, when the new census is being prepared, we may express the hope that the returns may give us full reports from the different sections of our country, by which we may be enabled to make such comparisons as will present the true state of affairs, and we can thus study more accurately our position as regards the death-rate from tuberculosis: the decline in the death-rate, if such has taken place in all the localities, especially in connection with the general death-rate and population; or, if in any place there has not been any decline, then we may be enabled to comprehend the reasons therefor.

What has seemed to be needed is that the constituent members of the Association should be furnished with the data on the subject of tuberculosis,

if possible, carefully considered by a master-hand for statistics. All our reasoning will be in vain if founded upon erroneous statistics or wrong conclusions. Those of you who heard or read Professor Robert Koch's address on the Prevention of Tuberculosis, delivered in London at the meeting of the International Congress in 1901, will recall the view which he there expressed about the most essential part of the warfare. This consisted in the expression of the view that he entertained about the relationship between human and bovine tuberculosis, and that it was most important we should guard, by all the means in our power, against the conveyance of the disease from one human being to another, and that the other we must consider subordinate. This statement, as you all know, was the cause of rigid investigation by national commission and by individuals, which have not ended yet, and which have led to the acquisition of much valuable information.

Our valued member and former president, Dr. H. M. Biggs, received an encomium, well deserved, for his part in the conduct of the work in New York city, especially with relation to the notification in tuberculosis, which has been, as you know, at first voluntary, then partially compulsory, later compulsory. You are all familiar with this phase of the matter, not alone from the publications of the Board of Health of New York city, but also from the proceedings of the International Congress on Tuberculosis, held in 1908 in this city (Washington), which can be readily obtained in the Proceedings of the Congress in the section on the Municipal Control of Tuberculosis. There has been, as you will recall, much controversy over the notification; but without it, and without the registration arising from it, a thorough control of the warfare in a city of the composition and varied nationality of New York would be impossible. As this has been adopted by many other cities, and also by the State of New York, the reasons which are cogent for it have been presented, and those opposed to it as regards certain places have been considered in various discussions.

Prevention is more valuable than cure, not only for the individual, but also for the city, State, and nation. Those methods which came into vogue first would naturally be those suggested with a view to curative results in the individual person; hence sanatoria were for a time chiefly recommended for the so-called incipient cases. The perusal of the reports of these institutions and of literature shows, as we would anticipate, that those cases do best, and among them the largest proportion of cures is obtained. As a certain proportion of these do not get well, remain stationary, or progress to a certain advanced condition, this residence in a sanatorium is admitted on all sides to be a preventive measure, by the education there enjoyed, so that when the

disease reaches the more advanced stage, patients are less of a danger to those with whom they are in intimate relationship.

We must admit, then, that the sanatorium for the early cases is, even if not successful in eradicating the disease, very helpful in the conflict which is being waged. Owing to the limited accommodations, however, not infrequently the so-called "incipient" case has become advanced while awaiting an opportunity to enter a sanatorium. While we must have sanatoria for the early cases, I think that, at the present time, the admission would be generally conceded that the institutions which receive and retain the advanced cases are of the greater value in the warfare against the dissemination of tuberculosis. The grounds upon which this is based are so well known that the mention of them seems to be a waste of time. In that very readable, instructive, and commendable book, "The Prevention of Tuberculosis," issued by Dr. A. Newsholme, who gave a lecture on the subject at the International Congress, the whole subject is very ably handled; in fact, great stress is laid upon the segregation of the advanced cases, more especially as the main cause for the reduction of the death-rate from tuberculosis, especially in Great Britain. The study which he has made on this subject is worthy of great consideration.

You are undoubtedly aware of the provision, partly of a compulsory character, made by New York City, for those who are a constant menace to others by their thoughtless, careless, or wilful habits of expectoration in the advanced stage of the disease. It seems to the speaker that this segregation of the more advanced cases will come to be regarded as a rather essential feature of the warfare.

At this time there exists an opinion which is worthy of careful thought regarding sanatoria—that they should care for all types of the disease. Of course, it is necessary that provision should be made for the more severely ill, so that they should not become sources of danger nor of mental distress to those less seriously sick. This, in my judgment, does not obtain in large cities, where groups of individuals have to be considered, but for smaller places, where different types, smaller in number, can be more readily separated from each other. There are so many considerations which favor the placing of sanatoria for residents of the large cities at such a distance that air, free from dust and injurious smoke and vapors, and possessed of that quality which is not readily defined, but of which most of us have experienced the benefit, may be obtained. If you will pardon the recital of a personal experience, I might mention that when a lad of fourteen years of age, having had a protracted cough which had failed to yield to remedies and slight local change of residence, it disappeared as if by magic on going to a distance in the interior of New York

State. This has always made me a convert to the benefit of sanatoria in reasonably accessible places, but possessed of such advantages in the way of scenery, hygienic conditions, and elevation as are possible. As regards those places which are designed as segregation hospitals, some of these factors are not necessary, and close proximity to the residence becomes a more important matter.

Our first president, Dr. E. L. Trudeau, deserves great credit for the establishment and maintenance of the Adirondack Cottage Sanatorium, which has been largely the creature of his efforts, together with those of his friends. The sanatorium celebrated in 1909 the twenty-fifth year of its existence, and it was rightly made the occasion of a general congratulation to its sagacious, benevolent, far-seeing, and optimistic founder. This institution, together with its laboratory, has been very helpful by example and by results which have been obtained by Dr. Trudeau and by his assistants in the contest against tuberculosis. Much has been accomplished there by the continued research regarding the right use of tuberculin, and by the possibility of securing immunity with its use, at a time when many discontinued its employment as a therapeutic agent. He has, as you know, continued its quiet and cautious use, and has helped others to demonstrate the right method.

As an adjunct in the treatment and prevention of tuberculosis comes the use of the dispensary, signifying, as some make it, rather a relief station than a dispensary, in the ordinary acceptation of the term, in large cities. How many of these there should be in proportion to the population and to the number of tuberculous invalids who would be controlled by them is somewhat of a question. Again, another matter for consideration would come up, as occurred in New York City: Should this dispensary be made a part of the ordinary dispensary, but under a different staff, and possessed of the means of employing such additional paid help, and having the resources to give such assistance as is especially necessary in the contest against tuberculosis? Such dispensary would be a place to which invalids suspected of having, or known to have, tuberculosis, could be referred for careful consideration, for judicious treatment, and for placement, if necessary, in the proper institution, since this dispensary would have knowledge of the number of vacant beds in these institutions. Also, as you are aware, there should be, besides physicians, a clerk or a nurse who would act as such, and a social worker who could investigate social and economic conditions. In the city of New York, at the present time, there are seventeen of these tuberculosis clinics or dispensaries. They are made up of such of the other dispensaries as are able to employ the proper assistants and give the needed relief. The reason why they were made a part of such of the general dispensaries as were willing to do this is a matter of

economy; and, even when dealing with a contest against a foe so insidious and so omnipresent, economy must be considered, because by so doing we can help more. Having secured a certain number, it is very easy to increase them when the patients are sufficient.

We have now, also, come into the field, the provision for such persons as are not as yet victims of tuberculosis, but, either by surroundings, inheritance, or exposure, liable to become such. These it has been proposed to make especial provision for, and to place them in institutions which shall endeavor, by suitable surroundings and good food, to make them able both to resist the disease and to become vigorous. My friend, Dr. Knopf, has proposed to call them "preventatoria," or "preventoria," which seems a very good term. At the same time, in the larger cities, certain hospitals have a convalescent hospital to which they may send their patients when recovered from the acuter stage of the disease, before dismissing them, still somewhat weakened by the effects of the disease from which they have recovered, in order to give them a greater vigor and greater resisting power before they get back to their homes or places where they might come into contact with tuberculosis.

In this way, by such additions to a general hospital in a surburban place, these convalescent hospitals become naturally an aid in the conflict.

Next among the great aids in the warfare against tuberculosis must be considered the thorough training of medical students in the ability to early recognize the development of the disease, or the suspicion of its existence in the individual. It seems that such instruction should be given in the essentials of physical exploration and of the use of the proper instruments and measures as would make of the coming generation of physicians doctors capable of early discovery of the presence of the disease. Also, they should be possessed of sufficient knowledge to admit a doubt, and to thus comprehend the necessity of reëxaminations.

The free examination of the secretions, especially of the sputum, for the presence of the tubercle bacillus, which has come to be of pretty broad general employment, starting notably in New York city, has come, moreover, to be a very important adjunct in the contest.

Mention should be made, also, of the seashore hospitals, or sanatoria, for the tuberculous children with bone and joint disease. The employment, also, of day camps and of night camps, to which children and adults can go so as to be in the open air at such places, is also extremely commendable.

The contest will not be considered carried to the highest point unless at the same time measures are taken to secure the avoidance of overcrowding, by the obtaining of suitable dwelling-places, and the measures for the disinfection

of the rooms which have been occupied by the tuberculous invalid. Thi alone can be properly carried out by a proper system of notification, of registration, and also by the dispensary. In New York city this would be impracticable without the Board of Health, because it alone is possessed of the powers.

When we consider these measures,—the education of the public on the subject, the publicity which has been achieved, both by lectures and printed literature, the laws against expectoration and about the disposal of expectoration and other discharges, the advice given with reference to abuse of alcohol, of smoking, and of injurious habits which weaken the body, proper mode of living and of ventilation, and sanitary care of the home, the shop, or working place, and also the other measures of which you are all aware, which have grown out of the knowledge of the bacillus,—we are struck by the improvement which has obtained over the conditions which were formerly in vogue, and it makes us very hopeful of victory, more or less considerable, in the fight in which you are all engaged.

The subject of bovine tuberculosis will be considered in the section on pathology. There is no question but that a pure milk supply is indispensable—or some means provided for guarding against the introduction of contaminated milk.

In conclusion, a well-planned coördination between the General Association and its constituent members might be made of great service in the struggle; thus some loss of energy and of expenditure might be avoided. As it is, with many schemes proposed, each of which is deemed most important by its proposer, yet with too many projects, some of which are of greater merit than others, an essential agreement, brought about in the way suggested, would lead to success. Again, certain ill-proposed measures would not see the light were the proposers to ask advice in relation to the general, rather than the local, consensus of opinion. United effort is always desirable, rather than irregular. There is no intention of hampering any one desirous of achieving results. Subordination to the good of the cause will produce the best results.

The Executive Secretary, Dr. Farrand, will now give you the results of the work of his office during the year.

REPORT OF THE EXECUTIVE SECRETARY

By Livingston Farrand, M.D.

New York

The record of the year just past has been one of expansion along lines already laid down and tested. A year ago we were reviewing the immediate results of the great stimulus of the International Congress, and the extraordinary growth of the antituberculosis movement during the previous year made it appear likely that the present report would indicate a slackening of energy as an inevitable consequence. It is a great pleasure to be able to state that this has not been the case, but that the movement has progressed with unabated strength and vigor.

The local propaganda of the National Association has again concentrated on the southern states and on the middle west. In the south, Tennessee, Georgia, and the Carolinas have been successively the points of attack, and since our last meeting highly successful exhibitions and campaigns have been conducted in Augusta, Savannah, Charleston, Columbia, Greenville, Greensboro, and Raleigh, with a special local campaign in Knoxville to round out the work in Tennessee.

The western field of operation since last May has covered Kansas, Colorado, Oklahoma, and Arkansas, with local campaigns in Topeka, Manhattan, Emporia, Lawrence, Pueblo, Colorado Springs, Denver, Oklahoma City, Guthrie, Shawnee, Muskogee, and Little Rock. These have been the means, particularly in Oklahoma and Arkansas, of opening up a territory where hitherto no steps had been taken.

The year's campaign has thus brought us within sight of our goal, where every section of the United States shall not only have been stirred by an active propaganda, but shall have, as a result, a permanent organization charged with the responsibility of bringing about an adequate equipment against tuberculosis.

The general operations of the Association have developed to the limit of our means and facilities. For two years now especial emphasis has been laid on

the work of the Bureau of Publicity. Under the energetic charge of Mr. Philip P. Jacobs, of the Executive Office, fortnightly bulletins are issued to nearly 6000 newspapers in all parts of the United States, while in addition nearly 5000 weekly bulletins are distributed through the Western Newspaper Union and the American Press Association to smaller newspapers in the rural districts.

Items of special interest, which were of such nature that they could not be sent out in regular bulletin form, have been issued to the Associated Press, the United Press Association, the Publisher's Press, and the International News Syndicate. The coöperation of these four syndicates, which practically control the wire news service of the country, has been very cordial and has helped materially to extend the scope of this branch of our work.

By an arrangement with the International News Syndicate a 1000 word editorial is furnished nearly every month to some 200 of the leading papers of the country.

With regard to the number of readers reached by the Publicity Service of the office it is, of course, very difficult to give an exact figure. A year ago we estimated on a conservative basis that fully 3,000,000 readers were reached fortnightly by our publicity work, but, taking into account the enlarged service of today, it is not too much to estimate that at the present time this figure has been more than doubled.

In discussing methods of publicity it is in place to mention the plan of a "Tuberculosis Sunday," which has just been brought to a successful conclusion. The plan was, briefly, to procure as many churches of all denominations as possible in the United States to devote a part of some service on Sunday, April 24th, to the presentation of the problem of tuberculosis and its prevention.

While it is still too early to give an accurate report on this effort, it can be said that the result has more than fulfilled all expectations. Approval of the plan was general. The President of the United States, in a letter to the Association, indorsed the idea in unqualified terms. Sixteen governors of States expressed their cordial sympathy and approval of the movement. Seven of these governors issued formal proclamations calling for the observance of April 24th as Tuberculosis Sunday in their respective commonwealths. Thirty-one mayors of the larger cities of the United States issued similar proclamations, while many other mayors gave to the plan all the publicity possible through their local press. Leading clergymen in almost every denomination coöperated, while interdenominational bodies of all sorts assisted in making the plan a success.

As a general result we may safely estimate that not less than 50,000 sermons

on the subject of tuberculosis were preached on that day. The amount of publicity given to this movement in the newspaper press, both before April 24th and since that date, has been without precedent, and it is to this phase of the plan that we must ascribe much of the benefit which will undoubtedly accrue.

Special mention should also be made at this point of the bill-poster campaign, the outlines of which are already familiar to many of the members. In July of last year the Associated Bill Posters of the United States, at their annual meeting, held in Atlanta, voted to donate to the National Association the vacant space on the bill-boards of the United States for the posting of educational material on tuberculosis, and further offered their services free in the posting of such material. The Poster-Printers Association, in a similar way, later voted to print such posters free of charge.

The contribution thus offered by the bill-posters of the country is estimated to exceed $1,000,000 in value.

Unfortunately for the complete success of the plan, an immense amount of paper was necessary, and this the National Association has not been able to secure in sufficient quantities. Nevertheless, a considerable amount has been donated by the paper manufacturers, so that some 30,000 posters are now being printed, and a number are already being distributed for use in various cities of the country. It is hoped that this coöperation, so generously offered, will be continued until the plan can be brought to the successful conclusion which its magnitude warrants.

As an example of the rapidly extending influence of the Association, and the unexpected way in which incidental activities open up new fields of opportunity, the following may be cited:

At the request of several prominent Chinese students in America the Executive Office prepared a special bulletin of information and advice, and sent it out, with a personal letter, to every one of the 600 Chinese students now residing in the United States. The object of the bulletin was to combat, if possible, the traditional habits of Chinese students in totally neglecting their physical welfare. Not only did this bulletin meet with a most cordial reception from those for whom it was primarily intended, but it would appear that this comparatively insignificant piece of work has been the means of initiating a National movement against tuberculosis in China, funds for which purpose are now being raised. The bulletin has been translated through the University of Nanking, is being circulated in all parts of the Chinese Empire, and plans for a systematic and extensive educational campaign are being laid down as a result.

It is impossible even to mention the details of these phases of the Associa-

tion's activity. Coöperation with special classes of the population is naturally made a particular feature. For example, a series of educational lectures has been prepared for delivery before the local branches of the International Printing Pressmen's Union. A similar series of articles has been prepared for use in the various Odd Fellows' journals, and by such means as these hundreds of thousands of workingmen are reached in a direct and convincing way.

Turning to the subject of investigations, it can be stated that the study of the cost of sanatorium maintenance has reached the first stage of completion, and now awaits the criticism and suggestion of authorities on the subject. The detailed analysis of the operating expenses of 30 institutions in various parts of the United States has been completed, the institutions having been classified and studied according to capacity and the number of hospital days treatment afforded, as well as according to geographic location and other available factors. The expenses of each institution have been classified under some 30 different items and averages for each item in their respective groups have been worked out and studied. The entire analysis has been carried through on a per capita per diem basis. While the results of this study are not as yet available for publication, they afford a mass of information of very great practical value, and are available for inspection in the Executive Office of the Association.

Another investigation of interest is a study of the tuberculosis mortality in American cities with populations of 30,000 and over. The inaccuracy of the vital statistics in the United States is notorious, and while this fact renders most difficult the obtaining of trustworthy figures on the points desired, it is hoped that the effort will stimulate to greater accuracy, even if the information acquired be not all that is desired. In procuring our information reports are obtained from all available official sources, national, State, and local. The discrepancies in the reports from these various sources are so great that they have already attracted the attention of many of the officials involved, and are leading to an active coöperation to better the conditions.

Of the publications of the National Association which have appeared during the year, aside from the annual volume of Transactions, the most notable has been a study on Sanatorium Construction, prepared by Dr. Thomas S. Carrington, of the Executive Office. A first edition of 1000 copies was rapidly exhausted and necessitated a second edition of equal size.

As a result of this and coördinate work, it has been found necessary to establish a Bureau of Sanatorium Construction in the Executive Office. There are being collected detailed plans of as many tuberculosis sanatoria and

hospitals as can be procured, which are available for committees and others concerned in the establishment and erection of new institutions. The need for such a concentration of information is shown by the fact that the office has coöperated during the last year with over 200 committees in the construction of new institutions.

One of the most important problems which we now have before us is to secure the wisest possible expenditure of the increasingly large appropriations for antituberculosis provision which are being made by our State Legislatures and various authorities. It is of the utmost importance, possessing as we do a lamentably inadequate provision for the care of indigent tuberculous patients, that accommodations shall be provided at the lowest possible per capita cost, both of construction and maintenance, compatible with satisfactory results. It is along this line that the Bureau of Construction is serving a most important end by suggestion and advice, and is likely to prove one of our most important fields of activity in the immediate future.

The Association is again under especial obligation to the Russell Sage Foundation for the renewed support which has made possible not only the activity of the exhibition campaign, but the continuance of the systematic publicity work just described.

The growth of the Association, while slow, has been constant. The number of members at the present time is 2270.

It has been customary to report at our annual meeting an outline of the growth of the antituberculosis movement in the country during the year just past, and possibly such a summary presents in a more impressive and stimulating way than any other the hopeful aspect of the campaign in which we are engaged.

A year ago it was stated that there were in the United States 297 associations for the prevention of tuberculosis. Today we are able to report the existence of 431 such societies—an increase during the year of 134 in this phase of the organized work.

A year ago there were 222 special tuberculosis dispensaries in operation, while today there are 286 in active service, being an increase of 64 for the year.

Of special tuberculosis sanatoria and hospitals, there were at the time of our last meeting 294 in existence, while today there are 393, being an increase of 99.

As to the actual increase in bed provision afforded by this institutional growth, our reports indicate that there are today 22,720 beds for tuberculosis patients in the United States. Of this total, 20,656 beds are now in use, while

the others are so definitely provided for that they may properly be included in a statement of total equipment.

One of the most important fields which requires attention is that of legislation. Since May 1, 1909, eleven State legislatures have been in session. In every one of these tuberculosis was a subject of consideration, and some law relating to the disease was passed. During the entire legislative season of 1909, 43 State and territorial legislatures were in session. Of this number, 28 passed laws pertaining to tuberculosis. A total of about $4,000,000 for the campaign against the disease was granted by the legislatures in question.

A very significant fact appears from an analysis of the public financial provision thus indicated. As nearly as can be determined, about 50 per cent. of the total expenditures of the country for the prevention of tuberculosis in 1909 were made from public resources. Present indications are, according to the appropriations thus far made for 1910, and the probable action to be taken during the remaining months of the year, that over 75 per cent. of the money expended during the current year will be from federal, State, county, and city funds. This fact is of the most encouraging significance, especially when it is considered that only a few years ago, with the opening of the Massachusetts State Sanatorium, practically the first definite public expenditures in the antituberculosis movement were made.

Such is a very brief outline of the state of our problem and efforts to solve it today, and it can be fairly stated that, stupendous as the task before us may be, the progress toward solution is encouraging. We have reached a position where our provision and equipment are such at least that the validity of our methods of campaign may be given a satisfactory test.

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St. Paul

INSURANCE AGAINST TUBERCULOSIS

By Lee K. Frankel

New York

The specific question which has been put to me by the Secretary of the National Association for the Study and Prevention of Tuberculosis is the following: Is it possible to devise a system of insurance in the United States which will undertake to compensate individuals who may be afflicted with tuberculosis, insure them the means of livelihood during their illness, and provide necessary treatment in sanatoria, etc.? The paper will confine itself to this specific proposition, indicating incidentally the methods in vogue in other countries.

The proposal of an insurance against tuberculosis is not altogether novel in the United States. In a paper read by the writer before the New York State Conference of Charities and Correction in 1901, entitled "Coöperation and Health Insurance for Consumptives," the effort was made to illustrate what was being done in Germany to care for individuals afflicted with tuberculosis, and to point out the preventive measures which had been introduced through the German system of insurance to prevent invalidity resulting from this disease. Attention was called in this paper to the fact that Mr. Frederick L. Hoffman had presented a paper at the British Congress on Tuberculosis in July, 1900, in which he arrived at the conclusion that it would be financially impossible and otherwise inexpedient for so-called industrial insurance companies to erect and maintain sanatoria for the treatment of tuberculosis. It was Mr. Hoffman's opinion that it was not within the range of remote possibility that industrial insurance companies would become interested in the sanatorium treatment of their consumptive policy-holders. It may be mentioned here that at the same meeting referred to Sir John Burdon Sanderson, speaking on the same topic, expressed his belief that an insurance system, such as had been developed in Germany, was not practicable in either England or America, and indicated that whatever steps might be taken in the direction of insuring individuals against tuberculosis would have to be accomplished through some voluntary insurance scheme.

It is interesting to note in this connection that since Sir John Burdon Sanderson's utterance on this question, England has taken two exceedingly drastic steps in its social legislation, similar to those previously instituted in Germany and in other European countries. We need only mention the workmen's compensation act, which, in its final form, makes it obligatory upon employers throughout England to indemnify employees for industrial accidents, and the even more radical legislation, under which old age pensions are guaranteed to English workmen at a certain age and under certain limitations. It should, furthermore, be mentioned, merely as a commentary on the above opinions, and as an indication of the rapid growth and change of sentiment in the United States, that a fraternal insurance order, the Modern Woodmen of America, has established a sanatorium for the treatment of its tuberculous members; that another order, the Arbeiterring, and a labor union, the Brooklyn Federation of Labor, have the erection of sanatoria in contemplation, and that even an industrial insurance company, the Metropolitan Life Insurance Company, has made application to the Insurance Department of New York for the erection of a sanatorium in which treatment may be given both to employees and to policy-holders. In pursuance of this thought, the same industrial insurance company is organizing a nursing service for its sick industrial policy-holders, with special reference to their care if afflicted with tuberculosis. In addition, it is distributing literature to its policy-holders calling attention to the nature and cause of tuberculosis, its prevention, and cure.

Medical authorities on the subject of tuberculosis have likewise been insistent upon the development of some plan which might insure treatment of tuberculosis to workmen and others. In a paper presented by Dr. S. Adolphus Knopf on "Life Insurance in its Relation to the Prevention of Tuberculosis", at the meeting of the American Association of Medical Examiners in Atlantic City, N. J., in June, 1909, this important matter was adverted to, and the same authority has in his recent publication, and in other pamphlets, laid stress upon the necessity of such a scheme for the comprehensive eradication of the white plague. At the meeting of the International Congress on Tuberculosis held in Washington in 1908 papers were presented by German authorities, who had been actively engaged in the tuberculosis campaign, illustrating the methods in vogue in that country, and showing how such an insurance plan tended not only to the reduction of mortality from the disease, to the limitation of the period of illness, but, of more importance, demonstrated the preventive measures instituted under such insurance schemes for the prevention and the eradication of the disease.

PRESENT METHODS OF TREATMENT, PREVENTION, AND CURE IN THE UNITED STATES

From the standpoint of a wise public policy, there are inherent objections to the method in vogue in the United States for the eradication of tuberculosis, and even against the methods in use for cure and treatment. While the recognition of tuberculosis as a social disease is comparatively recent, the knowledge that it is not only preventable, but curable under certain conditions, has spread rapidly. The application of this knowledge has become the task of individuals and associations in many cities and towns. For those who are in a position to pay, sanatoria have been erected in which the best and most approved treatment can be obtained. The peculiarity of the disease, in that it requires not days or weeks, but months and even years for its cure, makes such a course impossible for the great mass of workingmen and women in the United States. It can safely be stated that in a comparatively small percentage of instances is the workman afflicted with consumption able, out of earlier savings, to support his family, and at the same time pay for treatment in the average sanatorium, conducted for the purposes of profit. To overcome this difficulty, public-spirited individuals have constructed sanatoria as philanthropies, in which treatment for tuberculosis is given either at a comparatively low cost, or free of cost to individuals unable to pay.

Following in the wake of private beneficence, a number of States have erected sanatoria for the cure of indigent and semi-indigent citizens, in which, similarly, treatment may be obtained either without cost or at a nominal cost. The disadvantage of any such plan rests upon the fact that inherently the workman is a self-respecting individual who does not desire to be considered an object of charity. For this reason he refuses to become the beneficiary of a philanthropic enterprise which, in its last analysis, borders on the charitable. It is admitted by public and semi-public hospitals, managers of sanatoria, and dispensaries, that not all tuberculous individuals are reached by them, notwithstanding efforts made to supply proper treatment. In many instances this is due to fear on the part of the afflicted individual; to a dislike to have his affliction become known, and even to unwillingness on his part to believe that he is a sufferer from tuberculosis. Physicians and social workers who have had experience with this class will testify that there is a repugnance on the part of workingmen and women to accept treatment which puts them in the same category with the pauper and the vagrant. Instances could be cited where treatment in public hospitals has been deliberately refused by tuberculous patients because of unwillingness to come in

contact with a degraded element, who frequently, through viciousness, intemperance, and vagrancy, have become tubercular and incidentally public charges. Knowledge on the part of the sufferer that he is classified with the derelict, the incompetent, and the shiftless frequently repels him from making use of agencies at hand either under the auspices of private or public benevolence, in which treatment may be obtained.

If a comprehensive movement for the cure and prevention of tuberculosis is to be brought about which is to be of service to all consumptive individuals in the community, and which shall be ethical, such a movement must be based on the principle that treatment shall be given, not as a privilege, but as a right; that it shall be offered not as an act of charity, but as a benefit, to which the recipient is entitled, having made contributions prior to his illness to the fund from which the benefits are paid. In substance, that the movement shall be based upon insurance principles, and not upon public beneficence or private good will.

In its essentials, insurance of any kind depends upon the willingness of individuals to contribute to a common fund to be utilized for the purpose of protection, against death, sickness, accident, invalidity, old age, or any unforeseen contingency. The individuals constituting such a group, technically, the insurance company, or association, realize at the time they join that for the payments which they make they will be entitled to certain benefits when certain contingencies arise. This, in a nutshell, is the fundamental difference between the benefits of insurance and the gifts of philanthropy. The one must be accepted as a favor; the other may be demanded as a right.

VOLUNTARY INSURANCE AGAINST TUBERCULOSIS

Any discussion of insurance against tuberculosis in the United States must be based on the possibilities of developing an insurance plan which shall be voluntary in character. It has been assumed by legislators and others that any scheme which involves obligation or compulsion would be obnoxious to the underlying principles of the constitution; that proposals leading toward a compulsory plan would not receive consideration at the hands of legislators, or even, if such legislation might be effected, its subsequent enforcement would be impossible.

In the logical development of the question the possibilities of existing insurance companies would be the first to be considered. At the outset, it may be stated that there is no fundamental reason why private insurance companies, either stock or mutual, industrial or ordinary, should not undertake to insure their policy-holders against tuberculosis, that is, to insure them

treatment and other benefits in case they are afflicted. As an academic insurance proposition, such a scheme involves only the question of the amount of premiums to be charged the respective policy-holders. As a practical proposition, it would in all likelihood be found that the cost to the policy-holders would be high and might even be prohibitive. The difficulty lies primarily in the fact that an insurance company advertising to insure its policy-holders against tuberculosis would inevitably have what in insurance parlance is called an adverse selection. In other words, the individual with good ancestry and family history, who found himself in excellent condition of health and who had the impression that there was little likelihood of his becoming afflicted with tuberculosis, would have little desire or inclination to become a policy-holder. On the other hand, in a voluntary company, the policy-holders would be made up largely of men and women who had reason to believe that they had an inherent predisposition toward the disease; that past illnesses and present state of health might make them liable to be afflicted with tuberculosis in the future, or that they were already on the road to become sufferers.

An insurance company undertaking to insure policy-holders against tuberculosis could in a sense protect itself against this adverse and invidious selection in certain definite ways: 1. It might require all applicants to submit themselves to a rigid medical examination, and in this wise it could exclude all who could not conform to certain medical standards. 2. It might require all policy-holders to pay premiums for a definite specified time—say, six months, a year, or even two years—before they would be eligible to the benefits offered in the contract. 3. It might limit the benefits given during the earlier years either to reduced amounts or to treatment for a shorter term. While such a scheme may suffice as an insurance proposition purely, it would not accomplish the end desired in the treatment of tuberculosis as a social disease. The very process of exclusion above outlined would remove from the activities of such an insurance company individuals most likely to be afflicted with tuberculosis, would stop treatment at the time when it was most desirable that it be continued and, by limiting benefits other than treatment, such as, for example, the support of the individual's family during the period of illness, would only accentuate the social conditions which retard recovery.

Ordinarily, associations and insurance companies who undertake to insure their members and policy-holders against sickness must contend with the evils of simulation on the part of their members, which greatly increases the expense to the organization. The loss arising from this source would probably be negligible if such an insurance company would confine itself to tuberculosis

only and not extend its field of activity to other illnesses. Tuberculosis, today, is a fairly well-defined disease, and its diagnosis can be made by the average practitioner. Simulation, for this reason, would be limited in extent, and, as a matter of fact, an insurance scheme against tuberculosis would differ from insurance schemes against general sickness in that it would be the aim of the insurance company or association to give treatment even where the diagnosis was in doubt. It is possible that the cost of administration in an insurance company or association, national in character, would be higher than in a local one. It appears likely, from the experience obtained, particularly in Germany, as indicated hereafter, that the development of sickness insurance in the United States, and, in particular, of insurance against tuberculosis, which shall give treatment during illness to the beneficiary, and cash benefits for the support of his family during his illness, will evolve through local organizations, rather than through State or national associations.

Insurance against tuberculosis through voluntary associations may be considered from another viewpoint. It is well accepted today in European legislation, and beginning to be recognized in the United States, that industry is chargeable to a certain degree with accidents occurring therein, and that the employer should assume certain responsibility in meeting claims for indemnity arising from industrial accidents. As a result of this theory, European countries have departed from the old employers' liability theory, with its doctrine of contributory negligence, assumption of risk, etc., and in their legislation have adopted either a plan of workmen's compensation or of insurance against accidents for workmen without requiring proof on the part of the latter that injury was caused by the employer's negligence. This theory has been extended in certain countries not only to include industrial accidents, but occupation diseases, and compensation is granted for the latter as well as the former.

It would not be stretching this theory too far to assume that in certain instances tuberculosis may be considered an occupation disease. Long hours of work, not under the best sanitary conditions, frequently bring about a condition where the individual is readily susceptible to the germs of tuberculosis. It may be contended that along with accidents, industry should be held liable for tuberculosis arising through it. The modern trend of a more highly developed social instinct in industry leads to the assumption that it would not be amiss or out of place for employers of labor to coöperate with their workmen in devising schemes of insurance which shall guard them against tuberculosis. In many large industrial enterprises this attempt is already being made, through the organizations of sick benefit societies whose purpose is to give medical and other assistance to their sick members. Large labor organizations in the

United States make provision for members who become ill, and, as stated above, have even gone so far as to establish sanatoria for their treatment.

An enlightened public sentiment could probably be aroused through a persistent social campaign, which would materially increase the number of employers of labor willing to join with their employees in meeting the cost of an insurance scheme against tuberculosis. Through the medium of associations, such as the National Association of Manufacturers, who are studying the possibilities of a voluntary organization, made up of members of the association to insure indemnity to their workmen in case of accident, it may be possible to develop a similar insurance scheme against tuberculosis. There can be no objection to such a scheme. That its benefits would be far-reaching there can be no doubt. Its inherent shortcoming would be the one demonstrated by the experience of European countries. Wherever voluntary systems of this kind have been introduced, either through the industries themselves, as has been frequently done, or with the coöperation and subsidy of the State, in no case have they reached the great masses of men and women. Where there are intelligent direction and conscientious and altruistic employers, or where there is an organization of labor, competent to deal with the situation, it has been found practicable to extend material benefit in sickness to thousands of workingmen. But the small employer with limited financial ability has not been influenced, nor has the unorganized and unskilled laborer been provided for. The value of any scheme of insurance against tuberculosis, since it is a social disease, readily transmissible, lies not so much in being able to insure a selected number of individuals, but in the development of a comprehensive plan which shall undertake to insure all individuals and to guarantee them treatment if they become ill. It is only through such a comprehensive scheme that we may hope to realize the belief of authorities on the subject that tuberculosis may eventually be eradicated. It should be remarked here that at the International Congress on Social Insurance held in Rome in 1908, it was the consensus of opinion of the delegates from the various European countries present, and it was freely admitted even by those who, for years, had been exponents of voluntary insurance, that all efforts to reach the mass of the people through any voluntary insurance scheme had been unavailing. Even the delegates from Italy and France, who for years had firmly and persistently opposed the introduction of the principle of compulsion, freely admitted their conversion, since voluntary insurance had been found insufficient to meet the needs of the great public of working people in their respective countries.

This naturally brings us to the question of a compulsory system of insurance against tuberculosis. In Europe, particularly in the Germanic countries, com-

pulsion is not a code of mandatory laws, but the highest development of an ethical principle. "Compulsion", or preferably "obligation", in Germany and Austria, in Luxemburg, and in some of the other more northern countries, implies the recognition of a responsibility which rests on all citizens alike; namely, the responsibility of providing against the ordinary risks of life. Compulsion, as understood by the more enlightened in these countries, is not coercion. It is not a policeman with his club. It is not a form of benevolent paternalism foisted on an unwilling public by the powers that are made possible by centuries of education in military discipline and obedience.

Mandatory legislation is not an attribute of a monarchic or despotic form of government. It is known even in a republic. In fact, it is fundamental in our theory of government that the minority must bow to the will of the majority in all that affects the common welfare. The essential difference between the United States and countries in which compulsory insurance has obtained a foothold is the absence of recognition of any need for this form of protection for its inhabitants, and particularly for those nearest to the border-line between economic dependence and economic independence.

In certain instances we have adopted the compulsory principle in our own legislation. Under the laws of nearly all States the support of wife and children is made obligatory on the husband and father. Deliberate neglect of this obligation is classed as a misdemeanor and in one State, at least, neglect to support and abandonment of children by the parent have been made a felony. There are many statutes which direct the acts a citizen may perform, but there are as many others which explicitly forbid other acts of commission or omission. The police laws of most States restrict individual action within certain definite limits, and forbid voluntary initiative which may adversely affect public health, public safety, or the public weal. Laws are being enacted daily, miscalled socialistic or paternal, which on closer analysis are found to be no more than an expression of intention on the part of the State to safeguard the welfare of all citizens, irrespective of their economic status.

Fundamentally, no more than this has been done in Germany and other European countries which have introduced compulsory insurance. These have recognized that there are risks in life, common to all workmen, which it is impossible for the individual workman alone to make provision against. Only by the transfer of this risk from the shoulders of the one to the backs of the many and by placing the burden of cost where it should rest, even though this involve the industry itself, can equilibrium be maintained. In other words, where we, after an observation of a century, and England for several centuries, have grudgingly admitted the desirability of protection through insurance, and

through legislation have permitted individuals to avail themselves of the benefits of it, Europe, as typified by Germany and her sister States, has boldly declared the urgent need of this protection, not for the few, but for all of its working population, and by legislation has required its workingmen to partake of it, and its employers to bear their just share of the cost.

At the time the sickness insurance law was introduced there existed in Germany hundreds of small sickness insurance societies, which were taken into account by the law and were utilized as the vehicles through which sickness insurance might be afforded to workingmen. The remarkable development of thirty years has shown that, contrary to expectation, sickness insurance can be the best administered not through small organizations, but rather through large centralized societies, which have within themselves the power to bring about efficient administration to create machinery to prevent simulation, to give necessary treatment, and to develop preventive measures. This growth of the last thirty years is mentioned here particularly for the reason that the results obtained will probably point a way to similar movements in the United States. The experience which Germany has obtained through the conduct of its sickness societies can today be availed of by other countries. The experience of Leipzig and Dresden is valuable material and a guide to American cities. It will not be amiss to devote a portion of this paper to a slight explanation of what these cities are doing.

In each of the above cities there is at present but one sickness insurance society. In each instance the society is an aggregate of smaller ones which have been consolidated and centralized into one compact organization. The society collects from employers the necessary premiums, both the employer and employee contributing to the same. When sickness occurs among the members, the society provides medical attendance, medicine, surgical appliances, and, if necessary, treatment in hospitals, etc. In addition, it gives sickness benefits to the family of the member, dependent upon the premium payments which are based upon the member's earnings.

Naturally, under the head of sickness insurance tuberculosis has been one of the most important questions confronting the society, and it is fair to say that the question has been promptly and properly handled. The effort is made to reach every case of incipient tuberculosis as it arises. In the realization that he is entitled to treatment each workman a member of the club avails himself of his rights, knowing that he will be given immediate care and attention, and that, incidentally, should he be required to go to a sanatorium, his family will be looked after. Every effort is made on the part of the society in connection with the invalidity insurance department

to prevent a sick member from becoming incapacitated, since, if this occurs, it means that a pension must be granted during the period of disability. To prevent this and to restore the member to economic efficiency at the earliest date the society does not hesitate at radical measures. Members may be sent to health resorts and even to other countries if such treatment spells cure, at the expense of the society, all with the thought of restoring the individual to health at the earliest possible moment. Similarly, in connection with the invalidity department, sanatorium treatment is given for all consumptive members, and, it should be repeated again, this treatment is given not as a privilege, but as a right of the member based upon the fact that he has been a contributor to the society's funds.

In the realization that the prevention of tuberculosis means more than treatment the society, which includes members not only within the corporate limits, but in the suburbs, carries on an extensive campaign in the direction of the prevention of tuberculosis. Lectures are held at periodic intervals, literature of all kinds is distributed, and exhibits, showing the nature, character, and methods of the prevention of the disease are permanently established. The physicians who work for the society are expected to report every case in which they find the patient to be suffering from incipient tuberculosis, or where they suspect the disease may develop.

It may be of interest to cite some of the statistics of the society, particularly as they will bear upon the question of the introduction of similar organizations in the United States. The Leipzig sickness insurance club was organized as early as 1887, absorbing and displacing about twenty smaller societies. From the beginning, its jurisdiction was not confined to the limits of the city itself, and today its operation extends to the 42 suburbs within a radius of six kilometers. Its membership at the close of 1908 was 161,051, of whom approximately one-third were women. Of the total number, 15,000 were voluntary members. Nearly every industry or trade is represented. The management, in spite of the large membership, is democratic. As in most local societies, directors are elected at a general meeting held once a year.

Among other benefits, the members receive the following:

1. Free medical attendance from the first day of sickness, together with medicines, trusses, crutches, and other such appliances.

2. In case of disablement, cash benefits up to as high as fifteen marks per week for a period of thirty-four weeks, beginning after the second day.

3. In place of the foregoing, free treatment in a clinic, hospital, or home

for convalescents. In this case a cash benefit is given the patient's family equal to two-thirds of the usual cash benefit.

4. Free medical attendance and medicines to families of members for a maximum period of thirteen weeks.

In the year 1908 free medical attendance and its benefits were granted in 70,703 separate cases of illness. The total number of days of sickness was 1,697,796, an average of twenty-four days for each sickness; 5708 sicknesses were under four weeks' and 1290 over four weeks' duration; 10,006 members received treatment in hospitals at the expense of the society; 410 physicians are employed, each member being permitted free choice among them, unless he requires attendance at his home, when the physician practising in the neighborhood must be selected. In addition, the society employs 137 specialists, 23 dentists, 55 druggists, and 20 opticians. The society has at its disposal three convalescent homes, one of which, at Augustusbad, contains 200 beds.

Of special interest is the society's campaign of prevention among its members, aimed especially at tuberculosis. The physicians employed by the society are instructed to report the origin, treatment, and process of each case of tuberculosis under their care, and to notify the management of all cases which would seem to require sanatorium treatment. Of 1390 tuberculous members in 1908, 745 were thus taken care of. In a remarkably large percentage of cases either a complete or partial cure has been effected.

The society has at its disposal a day camp in the woods of Stotteritz, a suburb of Leipzig. Railway fare to and fro and luncheons are supplied by the society.

The disbursements for the year 1908 were as follows:

	Marks	Per Cent
Medical attendance	1,415,324	21.5
Medicines and appliances	680,887	10.4
Cash benefits to members	2,672,868	40.6
Cash benefits for families of members	159,345	2.4
Cash benefits for women after confinement	124,741	1.9
Funeral benefits	155,813	2.4
To hospitals, sanatoria, etc.	608,637	9.3
Managing expenses	573,336	8.7
Other disbursements	186,407	2.8
Total	6,577,378	100.0

Of possibly even more importance is a study which has been made of the mortality and morbidity of the Leipzig Society by the Imperial Statistical Department. These studies comprise four large volumes of statistics, and were carried out in the usual exhaustive manner in which German investigations are undertaken. It is impossible to reproduce more than a few of

these figures, which will bring out most pertinently one of the conclusions arrived at above, namely: the adverse selection which is made against a society working on a voluntary plan. The department made a separate study of the male and female members, and of those insured under the obligatory law and those who insured themselves voluntarily. The compulsorily insured hereafter will be designated as Group A, and the voluntarily insured as Group B.

Of the males insured in Group A, 347,725,923 days at risk were considered, which, divided by 365, gave 952,674 individuals under observation for a period of one year. In this group, 376,809 cases of illness occurred, or 39.6 cases and 854.9 days of illness for every 100 members. The deaths in this group numbered 7228, or 765 per 100,000 members. Only 1.2 per cent of the membership was under fifteen years of age; over 91 per cent. was between fifteen and fifty years of age.

For male members in Group B, 15,976,508 days at risk were studied, giving 43,771 individuals under observation for a period of one year; 34,370 cases of illness were cared for, giving 78.5 cases and 2860.2 days of illness for each 100 members. The deaths numbered 1426, or 3258 per 100,000 members. It will be seen from these figures that the number of cases of illness, days of illness, and the number of deaths were much higher in Group B than those in Group A.

The same fact holds true for the women members. The days at risk in Group A were 94,747,306, and in Group B 10,420,266, representing 259,582 and 28,549 individuals respectively. Cases of sickness in the former were 108,524, and in the latter 19,105. Calculated on the basis of 100 members, this gives cases of sickness in Group A, 41.8 and in Group B, 66.9. The days of illness per 100 members in Group A were 1030.3, and in Group B 2439. Even more illuminating are the deaths. The total number of deaths among women in Group A was 1380 and in Group B, 450, or per 100,000 members, 532 for Group A and 1576 for Group B. The above statistics are for all forms of illness occurring during the period of observation.

Among the male members who were insured in Group A, 7345 cases of tuberculosis were found, and among those insured in Group B, 1389. Days of illness from tuberculosis in Group A were 591,110, and in Group B, 133,938, giving a duration in Group A of 80.5 days and in Group B of 96.4 days. Deaths from tuberculosis in Group A numbered 2220, and in Group B, 510. On the basis of 100,000 members, there were 771 cases of illness in Group A and 3173 in Group B. The days of illness in Group A numbered 62,047, and in

Group B, they numbered 305,997, whereas deaths per 100,000 members in Group A were 233 and in Group B, 1165.

Statistics for women members are as follows: Number of cases of tuberculosis among those insured in Group A was 1637, and in Group B, 445. In Group A the days of illness were 131,882; in Group B, 37,574. The duration of illness in Group A was 80.6 days; in Group B, 84.4 days. Deaths in Group A were 549 and in Group B, 175. On the basis of 100,000 members, the cases of illness in Group A were 631, and in Group B, 1559. Days of illness were 50,806 in Group A, and 131,612 in Group B. Deaths in Group A were 211; in Group B, 613.

It appears evident, from what has been said regarding the development of the Leipzig insurance scheme, that a plan of insurance which requires all individuals to become participants in the scheme lends itself most readily to a comprehensive development not only for treatment, but for prevention of sickness and of tuberculosis in particular. This fact is given even greater weight by the statistics cited, showing the additional expense per member which is imposed upon any voluntary organization by reason of the adverse selection which is made against it by its members. Naturally, cost is an important item in the consideration of any insurance scheme. Where this cost is distributed over the population generally, it falls with comparatively little weight upon each individual in the group. Where the cost rests upon the shoulders of a few, who by a process of self-selection are individuals more apt to become afflicted with tuberculosis or with disease, as is evidenced by the returns from the Leipzig society, the cost to each individual may become prohibitive.

European experience has demonstrated, at least to the satisfaction of experts in that country, that only a compulsory plan fully covers the situation. It does not seem at all likely that any such scheme can be introduced into the United States, even assuming that the constitutional problems involved could be overcome. It is the belief of able legislators and lawyers that there are features in our constitution which would prohibit any scheme of insurance compelling either the employer or the employee to pay definite premiums for such insurance. It is believed that any such regulation would conflict with the proviso in the constitution under which the property of an individual may not be taken from him without due process of law. On the other hand, it is equally true that this provision in the constitution as applied to a compulsory insurance plan has never been the subject of judicial review, and until it is presented before a court of last resort, no definite statement can be made as to whether a law, such as is suggested, would be constitutional or not.

Aside from this fact, however, it is questionable whether thinking people of the United States would desire legislation along compulsory lines. The entire tendency here has been to allow individuals a certain amount of free choice, and not to introduce more paternalism into the government than absolutely required.

If compulsory legislation, such as has been adopted by Germany, is, therefore, not a matter of the immediate future, the thought naturally arises whether a compensatory principle, such as has been suggested in case of industrial accidents, might not be applied to cases of tuberculosis arising through industry. If it can be demonstrated that, to some extent at least, tuberculosis is an occupation disease, that it results from excessive hours of labor, from unsanitary conditions in workshops, mills, and factories, from devitalization due to insufficient wages, there might be good reason for attempting legislation which would impose upon industry through the employer, compensation to workmen for the consequences of industry which bring about tuberculosis. It is, however, still a question whether even the principle of compensation for industrial accidents, as recently developed in bills presented in certain State legislatures, would be more constitutional than the principle of compulsory insurance. We shall probably have to wait for the enactment of workmen's compensation legislation before we can determine whether tuberculosis may be included therein as an occupation disease.

There remains to be considered in what way voluntary schemes can be developed which will, to a greater extent than at present, assist in insuring individuals against the ravages of tuberculosis. Admitted, at the outset, that such a scheme has decided limitations, in that it will not reach the great bulk of workingmen and women, as has been amply demonstrated in other countries, it must not, therefore, be assumed that, by reason of this failure, efforts to extend voluntary insurance should not be developed as fully as possible. Existing agencies, such as labor unions, fraternal orders, establishment funds, and insurance companies can materially enlarge their present sphere of activities by adding to the sick or death benefits which they give special treatment for consumptives, either through physicians, nurses, or in sanatoria. Whether cash benefits can be given during invalidity is a question of obtaining a morbidity experience, and the ability of the members or policyholders to meet the necessary charges. In addition, any of the above-mentioned agencies may coöperate with antituberculosis associations in the United States, or on their own initiative may undertake a campaign of education to instruct their constituencies regarding the care and prevention of tuberculosis.

Sickness insurance even on voluntary lines has had but very limited develop-

ment in the United States, aside from sporadic efforts made by labor unions, fraternal orders, and mutual benefit societies connected with industrial establishments. Any concerted or comprehensive attempt to introduce sickness insurance is as yet unknown. Any such effort on the part of a municipality, such as has been developed in Leipzig, Dresden, and Vienna, has not even been thought of in the United States. It is true that the splendid development in these cities is primarily due to the fact that the majority of members of the sickness societies are required by law to be insured. It may be assumed, however, in view of the enlightened public sentiment developing in the United States and the efforts that are being made on all sides to fight tuberculosis, that municipalities and towns might organize similar insurance societies either against sickness generally or tuberculosis in particular. There are reasons to believe that cities, through taxation, might accomplish the same results as those obtained in Leipzig and Dresden. The right of a municipality to tax its citizens is not denied. It is not stretching the imagination too far to suppose that a municipality might impose a tax upon its citizens, which tax should be used specifically for the cure of sufferers from tuberculosis, and to carry out preventive measures for the eradication of the disease. Such a tax might be imposed on the basis of wages, and be apportioned among employers and employees on the assumption that industry to some extent is responsible for the spread of tuberculosis. The taxes thus collected might be set aside in a special fund to be administered by a board of directors made up of representatives of labor and capital, similar to the organization of the Leipzig sickness society. The problem of the care, treatment, cure, and prevention of tuberculosis would be placed in the hands of the board of directors.

Many of the suggestions in this paper may still appear visionary, and in all probability there is little likelihood of their development in the immediate future. Many of them were thought visionary in Europe thirty years ago, and yet today they are accepted without cavil and are in working operation in many countries with the approval of governmental officials, employers, and workmen alike. The day must come when they will receive recognition in the United States. The day has gone by when social problems may be considered purely from the standpoint of philanthropy. It is contrary to an orderly scheme of things to permit individuals to work under evil conditions, to receive insufficient wages, to subject themselves to disease, and to expect that they shall be satisfied, when they suffer from accident or disease, to receive as a privilege the dole which charity or philanthropy is permitted to hand to them. Germany realizes that the State has distinct obligations toward its citizens. Not the least of these is protection against the risks of life and

health incidental to our complex industrial development. It is realized that the workman alone cannot protect himself against the contingencies of life, particularly against sickness, accident, old age, and unemployment, and that opportunity must be given to him, through some insurance plan, to realize that these contingencies, when they arise, will not deprive him of the means of livelihood. Tuberculosis as a social disease must be considered as one of these contingencies. As a social disease, it is recognized that its causes in many instances are obscure; that its effects are far-reaching and affect not only the individual, but the community.

That it is possible to devise an insurance scheme to meet the exigencies arising from the results of the disease there can be no doubt. Of more importance, however, is the conception that in such a scheme there shall be the opportunity to prevent tuberculosis. Precisely what system may be finally adopted in the United States is still problematic. That the subject is worthy of the consideration of the best minds and the best thought goes without saying.

DISCUSSION ON DR. FRANKEL'S PAPER

Mr. Frederick L. Hoffman, Newark, N. J.: The relation of life insurance to tuberculosis was quite fully discussed before this Association in 1905 in an address by Dr. Arnold C. Klebs, of Chicago, to which I was requested to reply. In the mean time I have had occasion to discuss the subject at the Philadelphia meeting of the International Tuberculosis Congress, and subsequently Dr. S. Adolphus Knopf has summarized his views and conclusions on "Life Insurance in Its Relation to the Prevention of Tuberculosis" in an address before the Association of Medical Examiners. Dr. Frankel reëmphasizes the conclusions of Dr. Klebs and Dr. Knopf,* and apparently it is his view that the German Government system of insurance alone offers a practical solution. To a certain extent he is fully justified in his praise of so-called German Government insurance, which, however, it is necessary to keep in mind, is not insurance in the true sense of the term, but rather a modified system of poor law administration, on the one hand, and a modified employers' liability law, on the other. The relation of this system of so-called insurance to the campaign against tuberculosis is rather involved, and not easily made clear to those who are not thoroughly familiar with the nature and function of a paternal government. Since the German Government insurance system is really a social institution, much can be done

* Medical Record, August 21, 1909.

in the direction of aid and relief through insurance institutions which would otherwise require to be done through the poor law administration or private charity. The heaviest burden under the German system of government insurance is the guaranteed support, in the event of invalidity or incapacity to work. Manifestly, the duration of such incapacity may extend over a long period of time. It is a widely variable element, which makes it extremely desirable to make use of every possible agency or method to reduce preventable sickness to a minimum. The case is totally different with life insurance companies, which guarantee only the payment of a definite sum in the event of death. To life insurance companies the problem amounts simply to the question as to whether the cost of the necessary treatment will be returned to them by premium payments which they otherwise would not receive. Differentiating between industrial and ordinary insurance, it is obvious, in the case of the former, that the premiums, and the sums of insurance involved, are entirely too small to make it possible for a company to extend the required amount of financial aid to policy-holders suffering from tuberculosis and in need of adequate treatment for the required period of time. Estimating that the average length of treatment is not less than ninety days, and that it will cost on an average $1.50 a day, it is clear that it will take about $135 to provide treatment, which would be practically the full amount of the average adult industrial policy. It requires no discussion to make it clear that no company would be able to advance the full value of a policy, even though the results of the treatment could be guaranteed, which, of course, is impossible. How far it would be possible to develop a special form of tuberculosis insurance, under which, by the payment of an extra premium, a person could insure for a sum sufficient to furnish sanatoria treatment, is an open question. Aside from technical difficulties, it is also an open and important question whether the public at large would become interested in a special plan of insurance of this kind, since the much greater risk of personal accident liability has not been sufficient to develop personal accident insurance to any considerable extent among workingmen engaged in more or less dangerous trades. The most serious objection, however, is the practical certainty of adverse selection, in that applicants for tuberculosis insurance would be primarily of a class more or less predisposed to the disease.

While, in my opinion, it would not be expedient or practicable to develop a special form of tuberculosis insurance, it requires to be stated that efforts in this direction have been made by several foreign companies, to which Dr. Frankel did not call your attention. The experiments are new, but at least one of them is of particular interest. The Trygg Life Insurance Company,

which is the largest industrial insurance company in Sweden, at the suggestion of Dr. V. Berglund established a tuberculosis insurance branch somewhat after the following plan: In return for an extra premium the insured is conditionally entitled to a sum of 250 crowns ($64.50), payable in cash, or sanatoria treatment for an equal amount. The sum paid is considered an advance on the sum insured, or, more properly, a lien on the policy to the amount stated. The policy must have been two years in force if without medical examination, and one year if with medical examination. The extra premium charge at ages under twenty-five is fifteen cents a week for every $250 of tuberculosis insurance, ten cents a week at ages twenty-five to thirty-five, and five cents a week at ages thirty-five and over. Tuberculosis insurance in this company must be taken out in connection with regular insurance. When a policy has been in force for a period of years there is a readjustment and, in the event that no sanatoria treatment has been required, the amount of regular insurance is increased accordingly. The company has protected itself against extraordinary losses by the precaution that the amounts may be reduced if the claims should prove too heavy, but it has subsidized the tuberculosis branch by a special fund out of its surplus, so that this contingency is not likely to arise.

In actual practice tuberculosis insurance has not met with the approval anticipated from the industrial population. According to the last report, very few persons had actually taken advantage of the plan.

The similar experience of a company in Finland, the Kaleva, has also not been satisfactory. It is also understood that a Dutch company has undertaken this form of insurance, but without much practical success.

Dr. Frankel has referred to the success of the Federated Insurance Institutions of the Hanse Towns, but you, of course, understand that these institutions fall within the scope of Government insurance, and that they are not operated upon a commercial basis. The results which have been achieved have unquestionably been of great benefit to the members, but it has never been maintained that the undertaking has been a financial success. The financial success would, under the German system, however, be a matter of secondary consideration, for the Government considers the whole system of insurance a social institution, involving State duties of protection, amelioration, and relief. A few figures regarding the Hanseatic institutions may, however, be of interest.

In 1908 there were 4593 applicants for medical or other treatment, and of this number 2658 were males and 1935 were females. Since it was established in 1891 there have been 37,230 applicants, of whom 21,308 were favorably

considered, while the others, for various reasons, were declined or refused treatment. Of the 21,308 members accepted for medical or institutional treatment, 13,692, or 64.3 per cent., suffered from tuberculosis of the lungs, and 1200, or 50.6 per cent., from respiratory diseases. Of the 15,584 members declined, 9589, or 61.5 per cent., suffered from tuberculosis and other lung diseases, so that a very considerable number, for reasons not precisely stated, were refused treatment and became a charge upon the community at large or their own financial resources.

The expense of treatment in these institutions has been fairly high, by German standards, and the average cost per diem for a case of sanatoria treatment on account of tuberculosis in 1908 was 5.68 marks ($1.35) for males, and 4.34 marks ($1.03) for females. In the aggregate the net expense incurred on account of medical and institutional treatment during 1908 was 697,200 marks ($165,933.60). The results, on the whole, may be said to have been satisfactory, and a considerable proportion of the members were restored to normal wage-earning capacity. The data, however, are not as conclusive as would be desirable.

What is being done in this respect by German Government insurance institutions is not being done by a single German life-insurance company. They have thoroughly considered the matter, but have come to the conclusion that, for financial and other reasons, it would not be compatible with the nature and purpose of their institution to combine philanthropy with business. It requires no involved statistical or mathematical considerations to prove that the treatment of life-insurance policy-holders suffering from tuberculosis would not be possible except in return for an extra premium, the cost of which would probably be excessive. The experiment of the Trygg, to which reference has been made, proves that the necessary extra premium, even for a very modest amount of sanatoria support, would be quite considerable. Policy-holders for large amounts can, of course, make use of the paid-up value of their contracts to secure proper sanatoria treatment at their own expense. The small average amount of industrial policies would not permit of this being done. As I had occasion to say in my address before the London Tuberculosis Congress in 1901, the industrial companies would not be able to recoup themselves if they were to advance to policy-holders suffering from tuberculosis the necessary amount required for institutional treatment. It is also extremely doubtful whether even the best possible treatment would secure the required financial results, which may be expressed in an after-lifetime of sufficient duration to return in premium payments the average cost of sanatoria treatment. This is not the object of the German Government or the compulsory social insurance

institutions, which combine accident and sickness insurance with invalidity and old-age pensions, and other social benefits comprehended more or less erroneously under the term insurance. It cannot be too often repeated that what the German Government does in this respect is not being done by a single life insurance company in the German Empire.

One of the most serious problems which would confront a life insurance company would be the difficulty of exact diagnosis. When it is considered that a negative bacteriological test of the sputum does not prove that the patient is not tubercular, we are confronted by the difficulty of finding other adequate tests to prove the presence of the disease which would entitle the applicant to institutional treatment.

Dr. Frankel has referred to the British Workmen's Compensation Act of 1906, and the fact that the act includes compensation for certain forms of industrial diseases. Unfortunately, one of the most important of these diseases, that is, fibroid phthisis, is not included within the operations of the act. The law-makers of England were naturally reluctant to include compensation for industrial lung diseases, because the burden would have been an extremely heavy one upon English industry. At the same time it would seem but simple justice that if compensation is proper for lead-poisoning, anthrax, glass-blowers' cataract, and other occupation diseases, pecuniary compensation should also be made to those who, as the result of continuous and considerable exposure to industrial dust, die prematurely from fibroid phthisis or tuberculosis of the lungs. It may also be argued that the high degree of consumption frequency in certain trades could be materially reduced by preventive methods which would largely eliminate industrial lung disease and make compensation unnecessary. In a measure this would conform to the practice of the German compulsory accident and sickness insurance system, which is scientifically co-ordinated to deliberate efforts at accident and sickness prevention. More good would result from an intelligent and rational administration of factory laws and sanitary improvements in industry than from the most skilfully devised system of workmen's compensation, or workmen's insurance, as the case may be.

The causes and conditions responsible for an excessive death-rate from tuberculosis in industrial pursuits require to be determined with greater accuracy than has heretofore been the case, and in this respect life-insurance companies have a distinct public duty to perform. Mr. Frankel has referred to the elaborate and thoroughly scientific investigation into industrial mortality and morbidity by the Leipzig Communal Sick Fund, but he failed to point out that the investigation was the result of a special grant by the German

Imperial Parliament of about $80,000. The entire investigation was placed in charge of the Imperial German Statistical Office, which acted in coöperation with the Imperial Board of Health, and, of course, the administration of the Leipzig Communal Sick Fund. The investigation included 1,284,576 persons exposed one year to the risk of sickness and death, and the results of the investigation are presented in four elaborate volumes, which include every essential aspect of the whole problem of industrial mortality and industrial disease. We have nothing to correspond to this investigation in this country, neither on the part of government nor on the part of life insurance companies, and while the fundamental data for an identical investigation are wanting, it is, nevertheless, true that a vast amount of useful material is available which is not being utilized, as it is the duty of government and of insurance companies that it should be. When we have an appropriation in this country of say $1,000,000 for a qualified statistical investigation into the essential facts of industrial sickness and industrial mortality, we shall have the first contribution of real knowledge which is so imperatively required as a basis for a better understanding of the facts that are required to be made known.

While it is not the duty of life-insurance companies to undertake practically hopeless experiments in a field which is essentially that of philanthropy, they have a broader and a larger duty to perform in contributing the results of their experience to the general fund of common knowledge on the subject of human mortality in its particular relation to social condition, habits, physique and industrial pursuits. The companies in their archives have vastly more useful data than any State or nation, because of the fact that their records cover a continuous period of observation from the time of entry to the date of exit, while in all public vital statistics only the single fact of death is made a matter of record. The companies know the facts of family history, of personal physique, of bodily temperature, pulse, occupation at entry, occupation at death, and many other important and suggestive elements which are not available for the population at large. In life-insurance experience it is possible to coördinate a large variety of facts, such as the relation of occupation to physique, or of family history to cause of death, or of locality to the duration of life, etc., but no such investigation in its entirety is feasible for the population at large. Strictly scientific contributions of this kind, combining the medical, statistical, and actuarial functions, would constitute the most useful contribution which the companies could possibly make to the cause of preventive medicine. No doubt the companies might go further and aid in the instruction of policy-holders in the essentials of preventable diseases, particularly tuberculosis, by means of educational literature, lectures, letters,

etc., and I introduced a resolution practically to this effect, which was unanimously adopted by the London Tuberculosis Congress of 1901. There are, however, great practical difficulties in solving the problem of effective education of policy-holders, but in any event a determined effort in this direction may be made at comparatively small expense. No company, however, would be warranted in making experiments in special branches of insurance as long as the evidence is wanting that they are really required as a public necessity, and that they give reasonable promise of satisfactory results. I repeat that the experiments that have been made in the field of tuberculosis in Sweden, Finland, and Holland have not furnished proof that such insurance is really desired at the premiums necessary to make it financially possible, and I repeat further that no German private life insurance company, operating on the mutual or stock plan, industrial or ordinary, has followed the German Government insurance institutions in granting facilities for the institutional treatment of tuberculosis. It seems to me that the system of German Government insurance on a compulsory basis is so entirely inapplicable to American conditions—and will be for many years to come—that it serves no practical purpose to discuss its provisions, although the results, of course, have considerable social and economic interest. What we require most in this country at the present time is more information and really accurate and conclusive data regarding the true rate of mortality and sickness from tuberculosis in industry, and I am aware of no institutions in a better position to aid the cause of tuberculosis prevention in this respect than the ordinary and industrial life insurance companies of this land.

The Chairman: Will Dr. Knopf speak on this subject?

Dr. Knopf, New York: I am not a life-insurance expert. All I can say is that I have seen in Germany wonderful results of the insurance companies which are under State supervision, and which have led me to believe that it would be a great blessing to our country if we would have some similar provision. While I firmly believe what Mr. Hoffman said, that it is a good thing to make investigation,—it is a good thing to find out exactly why we have so much tuberculosis among certain type of workingmen,—I believe it is equally good to take care of those already afflicted, and if we can do that by some insurance scheme, it will be of incalculable benefit to humanity at large. I once before attempted to suggest to some companies to insure at least the children, and I believe if such a thing could be done, they would perhaps never develop tuberculosis. I believe we must pay more attention to the rising generation and to the men and women, particularly to the mothers. If we

succeed by some insurance scheme in including the children, whether of tuberculous parents or not,—whether this can be done by compulsory method or not I am not prepared to say,—I simply wish to express my firm belief that insurance against tuberculosis must come, is bound to come, if we ever hope to eradicate the disease from our midst.

Dr. Charles Rayevsky, Liberty, N. Y.: In regard to this sort of insurance by fraternal organizations, some three years ago I studied the statistics of the Workmen's Circle and I found that this organization had about 1½ tuberculous members per thousand. When they accepted my scheme looking to the insurance against tuberculosis, and announced that they were about to organize a sanatorium, the membership greatly increased, but with it also increased the rate of tuberculous members. They now have about 2¼ per thousand. The scheme is that each member shall pay 60 cents per year insurance against tuberculosis. From a membership of 1000 you have $600, and these $600 will represent fifty-eight weeks of treatment, as each member is entitled to twenty-six weeks' free treatment. This institution is now being run only for about six months. As far as I am informed, these figures cover the expense perfectly. I do not know how private corporations would do it, but it seems to me that through fraternal organizations it is a very feasible thing to ask this kind of insurance, and I would like those that can do something through the fraternal organizations to try to do their best.

Dr. Woods Hutchinson, New York: I think in one respect we all must have been conscious of a feeling of disappointment and regret from the discussion which was an argument between these two experts on the subject of insurance against tuberculosis, namely, that the voluntary insurance companies as at present organized are entirely either unable or unwilling to undertake any insurance against tuberculosis. How much of that is due to the inherent nature of the case and how much is the attitude of the societies, I think is an interesting problem.

I must frankly confess that it has seemed to me for a number of years that our life-insurance companies have not been paying their just share of the expense of the improvement of the health of the community. We in the medical profession have been lowering death-rates, we have lowered the life-insurance companies' morbidity and increased longevity, and yet we are still paying for protection upon tables computed from forty to sixty years ago.

Now the companies take the position that inasmuch as they cannot immediately recoup themselves out of the payments of the individual policy-holders, it is utterly impossible for them to do anything toward insurance against tuberculosis. I do not think that this is good public policy, with all due

respect to such companies, nor a broad-minded, intelligent, philanthropic view to take of the situation. They have been reaping all the benefits of the work that the community and the medical profession have done, and have returned nothing to either the community or the medical profession for it; and now because they cannot instantly recoup themselves, they practically decline to consider such a proposition as this. It may be that they could not get it back out of the individual policy-holder, but I should like to see the matter studied out more carefully and scientifically, and from a broader and less selfish point of view.

I join with Mr. Hoffman in the wish that the masses of statistical material hidden in the archives of the companies could be secured for publication. But, for several reasons, there will be difficulties in the way that will not be readily overcome. However, the darkest hour is just before the dawn, and if the companies are either unable or unwilling to undertake this insurance, then it seems to me it will have to be done by the community as a whole, and I think the community is preparing to do this.

I had occasion to look into the matter a year or more ago as to the probable expense of an extermination campaign in New York city, and after carefully working out the number of consumptives in the community, the number of beds required to treat them, the length of time required for treatment, and estimating the amount of new infection that occurs every year from varying causes, it appeared that a sum of less than four dollars per capita for each inhabitant of the community would provide beds to care for all cases, and that a tax of little more than a dollar per capita per annum for five to ten years would take care of the cases, care for the family, and put the disease in a process of extermination. The communities cannot do this if they take the attitude assumed by the insurance companies, and if they did, we might just as well drop our campaign at once.

Of course, we have made wonderful progress, but at the same time there is an enormous amount of work yet to be done. We have 22,000 beds for the care of consumptives, and that is a fine, imposing figure, but it amounts to but about 5 per cent. of the total number of consumptives in the United States. The provision is utterly inadequate, and until we force the matter as a community and as a whole and assume the expense necessary to isolate the advanced cases, we shall simply continue the process that is now going on in New York city, of burying every year 10,000 persons from tuberculosis and having two new cases for every one we bury. Ten thousand deaths and 20,000 new cases has been our program for the last six years. Every advanced case we place in a tuberculosis home prevents two new cases, and we must direct our efforts

to these advanced cases. The funds of the community are abundantly adequate and ready to be used for this purpose.

Of course, any good thing that we want to do is unconstitutional in the opinion of eminent lawyers, but it does not make any difference whether it is unconstitutional or not; it is going to be done within the next fifteen or twenty years, and some way will be found to evade the provisions of the constitution if such evasion be necessary. Heretofore the activities of our legislators have been directed chiefly toward the safeguarding not of human rights, but of human property, and by that system of public policy 5 per cent. of the community have been enabled to gather up the property of the community at the expense of the other 95 per cent. Now we are entitled to regain our share, and the share of this generation and of future generations, by taxation of these accumulations of wealth, and we can do it through the government and as a mass, and have the disease exterminated inside of twenty years.

Dr. Edward O. Otis, Boston: It may not be known that two years ago, I think it was, the legislature of Massachusetts passed an enabling act which permits the working-people of Massachusetts to be insured at different savings banks throughout the State at practically the cost price, the State furnishing the medical examiner. This scheme was promoted and carried through by Mr. Brandeis, and I had the pleasure of listening to his exposition of it, and, if I am not mistaken, he stated that the ordinary insurance people made about 500 per cent. on their policies, or at least a large per cent. above the cost. Now, if that is the case, it seems to me that it might be possible for the insurance companies to use a part of that amount of gain in treating their cases of tuberculosis, as has been suggested.

Hugh F. Fox, Plainfield, N. J.: There was one statement which was made by Dr. Frankel in his most interesting paper, which I think should be qualified. It would be unfortunate to allow the impression to go out from this meeting that people who are cared for in our public hospitals are regarded as belonging to the pauper class. The whole trend of the movement for the proper treatment of defectives, and of all those whose physical condition constitutes a menace to society, is to provide for their care by the State or municipality. In all departments of this work we are urging the State, the county, or the municipality to do its full duty by making adequate provision for all such cases, and are insisting that the individual has the right to demand such treatment if his condition is such as I have described. The logical outcome of this eventually must be to make such treatment compulsory. The most important next step in this antituberculosis movement is to get the

State or county and the municipalities to recognize their responsibility by providing adequate treatment.

Just a word on another point. At a meeting which was held recently, under the auspices of the National Civic Federation, to discuss the report of the Employers' Liability Commission in New York, the statement was made that the United States Steel Company, which employs 200,000 men, had paid $1,000,000 during the past year in settlement for accidents to its workingmen. Assuming that this statement is correct, and estimating the average per capita annual wages at $800, the increased cost of labor to the United States Steel Company which resulted from these settlements is 0.625 of 1 per cent. Let us suppose that the company, under its proposed plan of caring adequately for its men in case of accident or sickness, found it necessary to spend five times the sum that it spent last year as compensation for accidents (which seems most improbable), the result would make the added labor cost 3.125 per cent. But the cost of labor in relation to the finished product which is turned out by the steel company is probably not over 20 per cent., so that the increase in the cost to the consumer, even on the liberal basis of our calculation, would only be 0.625 per cent. After all, it is the consumer who must ultimately foot the bill, and it is doubtful if an increased cost to the consumer of a trifle over ½ of 1 per cent. would cause a ripple of disturbance in the industrial world. As a matter of business, and in the interest of industrial efficiency, who would question an increase of even 1 per cent. in the cost of production, if this would provide adequately against the hazards of misfortune which the workingman has to face in the way of accident or illness?

While insurance against tuberculosis might be impracticable from the standpoint of an insurance company as a profit-making proposition, its feasibility is worth considering from the industrial standpoint. The industry could well afford to carry it on a coöperative basis.

Dr. Frankel: I have but very few words to add. I think, for the sake of record, it should be mentioned in connection with the Leipsic insurance scheme of which I spoke, which is a scheme for sickness insurance including tuberculosis, that the institution is perfectly solvent. I received this morning, before leaving my office, the report for the year 1909, which shows that they disbursed last year over 6,000,000 marks for the care of their sick members, which practically all came from contributions, that is, in the shape of premiums or dues, half of which were paid by the workingmen. It is not a charity at all. In addition to that, they have accumulated quite a large reserve, and it is a pure insurance proposition.

I think there is nothing more interesting in this connection, bearing out

particularly what Dr. Hutchinson has said, than that this is a question of discounting the future. To my mind the most interesting statement in the report is not in the text, but in the diagrams. Whereas the society has shown constant increases in disbursements for benefits, physicians, and sanatoria, the actual disbursements from year to year for death benefits are today just one-half what they were twenty years ago. In other words, they are bringing out what I have endeavored to show in my paper, namely, that insurance against tuberculosis eventually means lower mortality and lower cost for death benefits.

I hardly felt that my paper would be so badly misunderstood as it was by Dr. Hutchinson in assuming that I said a life-insurance company was either unfit or unwilling to undertake work of this kind. I am perfectly convinced, with Mr. Hoffman, that there are certain very distinct scientific rules that have got to be laid down for the guidance of an insurance company in precisely the same way as rules must be laid down for the guidance of a banking institution. An insurance company must go along safe lines, not only because it may wish to do so, but because the law compels it to do so. If they were to act otherwise, they would be called up very shortly by all the insurance commissioners in the United States. But that this problem can be worked out in connection, not necessarily with a life-insurance company, but that a scheme can be devised to insure individuals not against tuberculosis only, but sickness generally, I am quite positive.

I want to mention another word for fear there might be a misunderstanding. I had hoped that this might not come up in a discussion this evening, but the insurance companies do not make 500 per cent. on their policies, and I am afraid that the speaker got that confused with the fact that the Metropolitan Life Insurance Company will return to its policy-holders during the present year over $5,000,000 in voluntary bonuses by reason of the fact that within the last few years their mortality has been lowered, carrying out the very thing that Dr. Hutchinson suggested.

I repeat what I said in my paper. The form in which insurance against tuberculosis will develop is still problematical; whether it will be done by communities, by organizations, in municipalities or townships, I am not prepared to say. Whether it may be necessary to have mandatory legislation or not, I am not in position to say. My contention is that, except under compulsion, no comprehensive scheme of insurance can be developed that shall include every individual in the community and that shall lead eventually to the eradication of disease. After all, that is what we wish to do.

SOCIOLOGICAL SECTION

Chairman

BERNARD FLEXNER

Louisville

Secretary

FRANK E. WING

Chicago

The Chairman: If any justification is needed for the existence and importance of this section, it may be found in the optimism expressed in the watchword and prophecy of the Health Conference recently held in Albany under the auspices of the New York State Charities Aid Association.

No uncared-for tuberculosis in New York State in 1915, and no tuberculosis in 1920, will come to pass within the great State of New York without a corresponding improvement in conditions elsewhere in this country. Nor, indeed, will it come to pass at all without the combined effort of physicians and laymen, met upon common ground, united in a common fight against a common foe.

We are familiar enough with professional and scientific gatherings convened to discuss the etiology and cure of disease, but a sociological conference about a particular disease has been until lately something of a novelty. It may be taken to mean that the disease in question is not only an individual's misfortune, but to no small extent society's crime; that ultimate eradication is to be regarded not only as a boon to affected persons, but as a condition precedent to the vigorous well-being of society as a whole; and that the means to its conquest are to be found not only through individual effort on the part and in behalf of those affected, but in even greater degree through larger social measures calculated to establish curative and preventive general conditions. It is interesting to note the altered conception of the physician, which just such movements as this have helped to bring about. For a long time disease merely played into the hands of the doctor. A sick person was a case to whom the physician gave, indeed, unwearying attention, and in whose behalf he spared no effort, but he could think no farther. So little was known of the causation and spread of disease that nothing more than anxious solicitude for the individual was possible. The germ theory has, I venture to say, completely transformed the rôle of the physician, for it has emphasized the fact that both the cause and the possible extension of disease lie outside of the patient and are subject to control, and it has added to the rôle of science what, for a better name, may be termed sociological medicine. The physician is thus converted into a soldier fighting the battle of humanity. And so it has come that society relies upon him to push his inquiries and activities in every instance beyond the particular patient. Nor is his social rôle limited to the contest with tuberculosis; typhoid fever, malarial fever, yellow fever, epidemic meningitis, and other affections are likewise amenable to the type of action to which this Association is pledged. When the present battle shall have been won, we shall gird ourselves for still others, to the end that the earth may be made a fit habitation for a fit race of men.

BUDGET AND PROGRAM FOR A LOCAL ANTI-TUBERCULOSIS CAMPAIGN

By James Jenkins, Jr.

Brooklyn

A paper on a budget of a tuberculosis committee will necessarily have to deal more with the theory of the budget than with the actual details of expenditures, because the budget which would apply to a city of 1,000,000 souls would not apply to a city of 50,000. In treating the subject of the budget, the program for the tuberculosis committee will necessarily have to be touched upon, as the program and the budget are most intimately connected.

Absolutely necessary items of expense of every tuberculosis committee are the salary of the secretary and provisions for a stenographer, and possibly an office boy and general office expenses.

The advantages and disadvantages of being connected with another organization, such as an organized charity, have often been discussed. Our committee believes that the advantages outweigh the disadvantages. Probably the greatest advantage is in the saving of expenses. Tuberculosis committees can often use the same office with the organized charity, and can make use of the same telephone and sometimes share the stenographer.

The backbone of the work of a committee on prevention of tuberculosis should be the educational work, and consequently the expense account should include stationery, mailing expenses, and expenses for direct educational work, such as exhibits and lectures. If the city is a large one, perhaps a quarter of a million of people, the exhibit should be permanent and should be provided with a competent docent, who would be constantly at the exhibit and be able to talk to small or large groups. In smaller cities the exhibit may be loaned from some larger organization, such as a State or National Committee, and should only be used for a sufficient length of time to educate the people of the city as to tuberculosis curable, communicable, and preventable, and to inspire them to provide treatment in dispensaries or hospitals for the patients of the locality.

It has been proved that lectures on tuberculosis are more attractive and more effective if illustrated with stereopticon views. The expense of educational lectures with stereopticon views is about five dollars each, and the budget for any local committee would have to include as many times five dollars as it was found possible to give lectures in a city. Our experience in Brooklyn is that 50 per cent. of our lectures are illustrated, as we have found it advantageous to give brief talks in the public schools and parochial schools, in the morning or afternoons, when pupils are in the building, and at a time when the stereopticon cannot be used to advantage. It is sometimes necessary or advisable to advertise tuberculosis lectures, with cards of admission or bills, which is an added expense of about two dollars per lecture.

The secretary of a tuberculosis committee should be an executive secretary, and an ideal man for such a position is one who has executive ability, that is, one who is able to organize. He should know what other places have done, where others have made successes, and know what pitfalls to avoid. A man with ability and having this previous knowlege should be decently paid, that is, he should be paid enough to live, without thinking whether he must spend ten cents for lunch or can afford fifty; and have sufficient means so that if it would be to the advantage of his work for him to join one of the city clubs, he can afford to do so.

One of the most important points of any tuberculosis campaign is the general publicity work, but ordinarily this can be obtained with a comparatively small amount of money. In Brooklyn, during our first year, we believe that our committee had an unparalleled amount of publicity. We made it a point to become acquainted with the city editors of all the Brooklyn papers, and to enlist their sympathies and interest in our work; we kept stories going in the papers, both with and without illustrations, every week and often every day.

We also obtained the interest of the Brooklyn Rapid Transit Co., which controls all the transit facilities in Brooklyn. They gave us advertising privileges, which amount to thousands of dollars every year to the ordinary advertiser, but which cost us only the expense of printing. They granted us the use of the back of the transfers, of which 13,000,000 were issued each month, and on it we changed the reading matter about every two months. They also gave us advertising space in the cars, where we put signs regarding spitting; we also used the elevated stations, of which there are 250, for posters, which we changed every two months, and we hung health rules, neatly printed and framed, in all the elevated stations. The advertising privileges,

which we received from the Brooklyn Rapid Transit Co. would have cost the ordinary advertiser about $15,000 a year, without putting any value on the back of the transfer. We are told that the back of the transfer space in Manhattan, New York city, is sold for about $50,000 a year.

This work above mentioned is perhaps typical of the work a tuberculosis committee should do. It is to inspire others to do things, rather than to do them itself, at its own expense. Another explanation of the same kind of work is perhaps pertinent. We decided in Brooklyn that we needed more dispensaries for the treatment of tuberculosis, and that these dispensaries should be formed into an association, doing work coöperatively. Starting with one clinic a year ago, we now have eight, none of which costs us a cent, except for the letters which we write to the heads of the different dispensaries, from time to time, on questions of general interest. The outside nurses connected with these dispensaries are provided by the city, and the inside nurses and registrars are generally provided by the dispensaries or hospitals, and the cards for records, etc., are also provided by a City Board of Health. These dispensaries are spending, through the city and institutions, in the neighborhood of $40,000 a year. A necessary expenditure, but not a proper expenditure, for our committee.

Since the advent of the Tuberculosis Committee in Brooklyn 100 new beds have been added to the list for tuberculosis patients. Twenty of these are in a privately endowed hospital, about 80 in a city hospital, where two old pavilions were converted into a tuberculosis ward. Here again the community is spending money, but the tuberculosis committee is spending nothing but energy.

The duty of the tuberculosis committee in regard to these dispensaries and these extra beds is to see that they are properly maintained and to inform the public of them, and, further, to educate the public to take advantage of the treatment and beds, so that they will be used to the maximum of good to the community.

To bring out this last point of the need of educational work, in order to have the facilities for tuberculosis patients used, we might tell the story of a tuberculosis committee in a comparatively small town in the East. As soon as this committee was formed and had a little money in the treasury most of the members of the committee were heartily in favor of establishing a dispensary for the treatment of the tuberculosis cases of the city. The secretary, who had had a wider experience, urged them to do their educational work first and then, if necessary, establish a dispensary, but preferably try to inspire some one else to provide the necessary treatment. The majority of

the committee voted in favor of the establishment of a dispensary at once. The dispensary was established, and has been in existence for nearly a year, but no patients came to the dispensary.

There are undoubtedly a goodly number of cases of tuberculosis in that city, as in every other, and they could be cured by treatment at the dispensary and by private instructions as to their mode of living at home. But the failure was in not educating the public to understand the symptoms of tuberculosis and the need of early treatment, so that this perfectly good dispensary was not taken advantage of.

A word about the exhibit. A permanent exhibit cannot be properly run for less than $2000 per year. The man in charge should be paid about $100 per month, and incidental expenses of light, heat, advertising, repairs to exhibit, etc., will take the other $800. A good exhibit can be assembled for about $500. Some exhibits have been self-supporting; this is practically true in the case of the exhibit of the New York Committee on Prevention of Tuberculosis. Their income, received largely in small amounts, which are put in mite boxes at the exhibit, is paying the running expenses of the exhibit. In Brooklyn we are not so successful, our best receipts being $25, taken in in two weeks. If the exhibit is shown in the poorest parts of a city, collections will be very small.

One of the important duties of a tuberculosis committee is to investigate the local causes for the disease in its city. In a small town this investigation can be made by the secretary, but in a large city special investigators will probably have to do the work, and sometimes it is necessary to create a new committee for a special investigation. As an instance of this last condition we found in Brooklyn that it was necessary to get at the condition of the tenements as one of the causes of tuberculosis.

The tenement problem in a city as large as Brooklyn is so tremendous that it was necessary to have a committee formed on the tenement question, with a secretary appointed for that committee. Every committee should know the *social causes* for tuberculosis in their city, and then should *get after those causes*.

Although we believe that the work of a tuberculosis committee should not be relief work, yet we do believe that a certain amount of case work is expedient. This case work can be done by a special tuberculosis nurse, who does educational work in the homes of the consumptives and sees that the patients get into proper hospitals or sanatoria. This case work puts the committee in touch with the patients, and makes them realize the problems at first hand. It also obtains for them the sympathy of the public, who are not

yet sufficiently educated to appreciate preventive work. Tuberculosis committees should always work with both their heads and hearts.

Part of this paper should rightfully be given to the raising of money for a tuberculosis committee, as well as to the expenditures of it when raised. An *ideal* system of raising money is to obtain a large number of small contributors, paying annually. These contributors should be obtained when the association starts, as probably then the interest is freshest and keenest. The various ways to get these annual dues in order of results are:

1. Personal interviews by local people, presumably members of the committee.
2. Personal interviews by the secretary, who may be a stranger and have to be introduced.
3. Personal letters addressed "Dear Mr. Smith," and signed by an acquaintance.
4. Copy letters signed by several well-known members of the committee.
5. Printed appeals.

Hand in hand with the raising of money publicity must go. Just at the time you are sending out an appeal to several hundred citizens a good story article in your local papers about the work of the committee will help very much to interest your patrons and to remind them to send in their checks. Always make letters short, crisp, and businesslike, and, as far as practicable, send a one-page letter to cover the subject. In making appeals study the people of the city. It would be a great waste of time to ask a hundred-dollar man for five dollars. In studying the people of a city one learns that different groups of people give to different kinds of appeals. To one group you may appeal successfully for a diet fund, while to another you could send letters with success asking for the necessary expense of a constructive and educational work.

It is an excellent idea to vary the kind of appeal that is sent out and to take advantage of any local situation. For instance, in Brooklyn the money raised by the Red Cross Christmas Stamp was maintaining the "open-air school," and the committee found it necessary to pay the car-fare for a good many patients, and this car-fare item grew to very large proportions. One day a sweet-faced little woman came to the office of the secretary, telling a most appealing story about her struggles to keep her three children, all of whom had tuberculosis, at the camp. An appeal was sent out by the secretary, embodying this story, to the various Sunday-schools in the city, asking the children to give one Sunday's collection to pay the car-fare for the little children who were sick and less fortunate than they. The response was quick

and hearty. Another idea that was adopted with success by the Brooklyn committee was what we call a "seasonal appeal." At Thanksgiving time we wrote a letter saying: "This is Thanksgiving season, and our committee wishes to make it a real Thanksgiving in the homes of the sick poor." The letter went on to explain that we wished to make this Thanksgiving permanent, and that we were trying to make it so by visiting the poor consumptive in his home, giving instructions to his family, etc., outlining some of the work, educational, preventive, which the committee was doing. This appeal was naturally sent out just a few days before Thanksgiving, and was one of our most successful appeals.

The *easiest* way to make the finances of the committee independent is to interest a few rich men in the work of the committee, getting them at the start to guarantee the necessary running expenses. This guarantee need not be accepted in full if sufficient funds can be raised by the general public to warrant the refusal of part of the guaranteed funds. However, it is much better to have 1000 men give one dollar a year, than it is to have one or two men give this guaranteed amount.

In some localities the situation is such that a tuberculosis committee is really forced to do a certain amount of relief work, but the responsibility for this relief, even if initiated by the committee, should be placed as soon as possible on the shoulders of some regular relief organization which is in existence and which is perhaps not fulfilling its entire duty to the public. Or else a new group may be inspired to take up the relief work. It cannot be too strongly emphasized that the work of the committee on prevention of tuberculosis should be educational, constructive, and inspirational rather than remedial.

DISCUSSION ON MR. JENKINS' PAPER

H. Wirt Steele, Baltimore: It seems that of the making of budgets there is no end. From the making of the British budget, which has just been approved by the House of Lords, to the making of a budget by a State or local antituberculosis association, may seem a far cry; but is it? To my mind the making of any budget for any public work is, or should be, the first and last test of the efficiency of that work. The building of the budget is the measure, it seems to me, of the grasp of the problem by those who are attempting to solve it; for, after all, the budget is simply the itemized expenditures for the solution of a given problem; in this case, the solution of the problem of tuberculosis in each locality.

I think the budget should be prepared before the money is in hand to meet

that budget. I think it wiser to go to the public—or, as they say in the British Parliament, to "go to the country"—with your proposed expenditures than it is to say you will need a lump sum of so much money, and then, having secured it, determine how you are going to spend it. I think in the long run the psychology of the situation would justify that position.

It may not be out of place to tell you in a few words of our experience in Baltimore in the making of our budget. The first year of the Maryland association's life was simply a drive in the dark. The committee did not know what its tuberculosis problem was. The Governor had pointed that out in a special message to the Legislature, and they had believed him and had created a tuberculosis commission, giving them an appropriation for two years with which to study and state the problem. That apparently was the only duty of the commission. The commission spent this money and made a report, laying out pretty clearly just what Maryland had to face, proposing in its report a number of laws which were passed by the session of the Legislature to which this report was made. The commission then said to the public: "These are good laws. They are in advance of any other State now. We are pioneering the way, but these laws are not automatic, they will not enforce themselves, we need public sentiment to do that." So they issued a call for volunteers for the enforcement of the law. That was about the only thing they had in their minds at the time. The result of that call for volunteers was the organization of a State association for the prevention and relief of tuberculosis. At first its membership dues were its only means of revenue, and the membership, therefore, was deemed one of the most important things, and it turned out afterward that it was. We have a membership now of about 3000 people in a State of 1,000,000 population, and that in itself was the first educational propaganda. The commission and the infant association, in making its appeal, had to state rather definitely what needed to be done. The commission had prepared the way for this in its report. So there was a program mapped out. What the items would cost remained to be seen. The first year the income was not great, but was fairly wisely expended. At the end of the second year and at the beginning of the third year the association could lay out the budget in items and go to the public with that proposition. It based its appeal largely on the fact that the question needed further investigation, that that was fundamental, that we were going as fast as we dared go without additional information. The association deemed it wise and best to employ trained nurses to make such investigation and to promote publicity, which also proved, as we think, to have been wise. The association formed the actual administrative machinery, which is gradually being taken over by

the city, counties, and State. First of all, the tuberculosis movement offers a common meeting-ground for philanthropists and business men of all shades and distinction of differences of opinion, upon which they may come together without prejudice—a common meeting-ground that has not been presented before in many American communities. This should have been done by some of the charity organizations, but in some of the older cities and States of the east, we find that that has not been true. Charity organization societies in some States that have been in existence twenty or twenty-five years have failed to get the kind of coöperation that they consistently stand for because of the prejudice of many old philanthropic activities that have grown up through a century or more and have their traditions and their petty differences. They look upon a charity organization society as a competitor, and, therefore, there has not been that close coöperation that must obtain in order to get the best civic results. But here comes the tuberculosis movement that presents a platform and common meeting-ground where all these interests can come together without prejudice, and they are doing that, with the result that we are going farther into the public purse by means of the publicity we are building on than we could have gone in any other way. So that executive machinery is the first item of expense, necessarily and logically. The second item we feel to be one devoted to further investigation and the spreading of information. The nurse supplies that. The next item is the one of publicity: utilizing the newspaper, the bill-board, the street-car, and any and every means of securing publicity. Then may come, it seems to me, the day camp, hospital, or dispensary, just as the local situation demands. For instance, in Baltimore it has not been necessary for the association from its own funds to maintain a hospital or sanatorium or even a day camp or a night camp. We have maintained a nursing force, building it to a point where the problem was too great for any private philanthropy to bear, and by sheer force of numbers we were able to go to the council and provide five times the force of nurses that private charity had been able to secure. Baltimore now has fifteen nurses supplied in that way. We did establish a dispensary in a section not covered by existing medical institutions, but only with a view of maintaining it and keeping it there until the municipality would, in course of time, take it over and make it a part of a municipal dispensary scheme. I think, Mr. Chairman, that is about my idea of what a budget ought to be and what we have tried to make it in Maryland.

J. Byron Deacon, Philadelphia: The point of view I bring to this Association is that of one who has been a secretary of our associated charities and of its tuberculosis committee in a manufacturing city with a population

of 125,000, and later secretary of a State association, in connection with the work of which has been the obligation of organizing antituberculosis societies in cities ranging in population from 10,000 to 60,000.

The program and budget of a local antituberculosis society, as I have thought it out, are inseparable. I shall try to outline what seem to me to be the indispensable elements of any local antituberculosis program, and to try to classify, on a percentage basis, what proportion of the fund available for local work should go to each of these essentials of the program. As to the program of prevention in any locality: First, I think it should include investigation; second, educational work; and third, measures looking to securing municipal coöperation. There should be an investigation of the prevalence and the causes of the disease in the homes and in the working-places. The causes attributable to municipal neglect—neglect to secure registration of known cases, neglect to disinfect houses, neglect to pass compulsory removal ordinances, neglect of proper supervision of milk and meat supply, and neglect through allowing congestion—should be plainly indicated. The investigation should include this, and it should also include a survey of remedial agencies in a given locality.

Confessedly, there is no city in the country where an investigation has not been undertaken that knows its tuberculosis problem; and I think an additional value of investigation is that it gives point to a society's educational and publicity work. For example, it is much more significant to say that in Erie, Pennsylvania, from year to year there are 75 deaths from tuberculosis, than it is to say that in the United States 100,000 people or thereabouts die annually from tuberculosis. The significance and vital interest of statistics are increased in proportion as the field is narrowed.

The educational program should be based on the findings of the foregoing investigation. There are three features of an educational program which are commonly admitted to be essential: First, an exhibit, lectures, general newspaper publicity, and publicity through posters, etc. As to the exhibit, it should be placed before the general public and before special groups of the populace, as school children, factory employees, laborers. The lectures should be given in schools, churches, before labor unions, etc., and preferably the lectures should be illustrated. I think it advisable for the local society to prepare its own lantern slides. In connection with lectures, it would be a great advantage for more societies to do what has been done by the New York Charity Organization Society's Tuberculosis Committee, and that is to prepare a syllabus of a standard lecture on tuberculosis. The advantage of the lecture

outline is that its use is more likely to insure the emphasis on the points which it is desirable to bring out. We found in Philadelphia that there were a great many volunteer lecturers, even physicians, who lectured in connection with our exhibit, who emphasized precisely the elements which we wanted suppressed, namely, the gruesome and horrible phases.

Newspaper publicity is a relatively easy thing to get, but a very practical difficulty which is encountered nowadays is the objection, on the part of the editors, that "all this stuff you are submitting is simply a rehash. We have had it over and over again," and it puts the social worker to a great deal of hard thinking to devise articles and stories and methods of publicity which will be acceptable to the editors.

I think the most important element in any program is the part which looks to getting the municipality or county to assume greater responsibility for controlling tuberculosis and greater activity in its combat. Any effort which a local society makes in the direction of increasing the tendency on the part of local physicians to register cases is well done. It is very important, as soon as public sentiment is ripe, to ask for an appropriation for some municipal work essential to the control of the disease. For example, a hospital for the care of the advanced tuberculous where there is no such institution. This part of the program should be supervised by committees on municipal coöperation and on education.

Following, I have classified on a percentage basis what seem to me to be the necessary expenditures for a local campaign. First of all, you must pay for service. Under service is included the necessary clerical expenses and also the expenses of the executive, the organizer. The organizer should perhaps conduct the investigations. He should be a constant stimulus to committee activity, and that committee activity in turn should stimulate the entire populace. I have allowed 50 per cent. of the entire budget to cover service. The second class of expenditures is rent, telephone, and various office supplies, stationery, etc., and the cost of raising money, and I have allowed 20 per cent. to cover that. Third, I have placed the expenditure necessary to maintain the various features of an educational campaign, for the maintenance of an exhibit, and also the expense of lectures and the printing and distribution of literature—all of this can be borne for approximately 30 per cent.

The field from which financial support for antituberculosis work may be derived narrows in proportion as the emphasis of the program is laid on prevention. The appeal of a sanatriuom which exists to cure is general, but the appeal made by a program of social investigation or a program including the maintenance of a hospital for hopeless cases is very limited. I think for an

antituberculosis society to adopt a program adapted to the size of the fund which happens to be on hand, or which there is entire certainty of raising, regardless of the work which needs to be done, is to invert the right order. I believe the right way to begin is to determine the local needs, plan the program with reference to the needs, and make one process of carrying out the program and financing it. Of course, the process of raising money generally reduces itself to the establishment of a live finance committee.

In conclusion, I would like to make a suggestion in the form of a question. Why should not the National Association for the Study and Prevention of Tuberculosis establish a bureau of information on finance methods for antituberculosis workers similar to the Field Department of the New York Charity Organization Society? It seems to me a thing which would have an excellent influence on the technique of money-getting for antituberculosis work.

F. A. Sampson, Louisville: There are just one or two points in connection with the work in cities smaller than any of those represented by the gentlemen who have just spoken that I would like to touch upon very briefly. In the communities where there is a lack of proper hospital facilities or nursing facilities, and where the efficiency of coöperating agencies is not at its highest, local tuberculosis workers are often obliged to include many needs in their program which, at a later time, can be carried on in their proper way by the proper agencies after the inspirational work, which Mr. Jenkins has reminded us of, has been done. In the mean time the struggle for funds to meet this work, which does not properly belong to an antituberculosis organization, oftentimes takes a great deal of the energy of the organization. It would seem, as Mr. Jenkins indicated, that perhaps the ideal way of financing a pioneer independent organization would be through small contributions or through membership dues—a wide-spread dues-paying membership, each member of which might be made a center about which could be built up the sociological work which has to be done. In Louisville we have endeavored to keep up a lively interest in the membership of the association, making the members feel that they were really members in fact, and not merely annual contributors. The membership year of any individual does not necessarily coincide with the fiscal year of the organization, but is dated from the month of his application. As his membership expires a statement of dues is sent to him instead of a letter asking "if you will not again contribute as you did last year." By sending such a letter, a great many people would feel that all obligation was removed, but when sent to them in the form of a statement, they will very readily contribute and continue their membership. The membership dues of the association are from five dollars annually upward,

the membership in the association being divided into special classes for amounts greater than that. An associate membership of one dollar a year is provided for those who do not feel able to contribute the regular dues. It would seem unwise to establish any class of membership dues at less than one dollar per year for the reason that practically the entire income from this source is expended in postage to members and in the incidental expenditures of keeping in touch with them, so that practically none of the income from such members is available for the work of the organization.

During the life of the Louisville association—about five years—the annual receipts from membership dues have averaged about three thousand dollars, which is approximately four dollars for each member. A very large part of this membership was recruited through the efforts of a lecture committee in its campaign of talks in the churches of the city. This resulted in securing a great many members. It had the effect, however, of closing a great many platforms and pulpits to tuberculosis lecturers. It may seem a little strange, yet there is considerable hesitancy on the part of ministers and others to having a tuberculosis lecture if they think there is going to be any demand for membership dues or for contributions of any sort, and even after a lapse of two years after a campaign of that sort, a great many of them want an assurance that there will not be any request for membership dues. It is notable that the failures to renew membership have come almost entirely from the class of membership secured in this way. The membership plan of raising funds unquestionably commands keener individual interest in the work among contributors than spasmodic or periodical contributions. I have been frequently reminded by contributors, not that they had contributed before, but that they are members of the association, and I have found, among a great many men of affairs, that the fact of their membership in the association had not been lost sight of. The membership receipts of the Louisville association of three thousand dollars annually have not been at all adequate to supply the needs of the association, and various financial campaigns have been resorted to to supplement this amount. The most successful of all these campaigns was one carried out on recognition of the fact that in the general public there is a large part unable to contribute in a large way, who would be glad in a small and modest way to contribute if a proper opportunity were afforded them. A "Ten-cent Day," as it was called, was organized, and a house-to-house canvass was made, asking for only ten cents, but from absolutely every individual. There was hardly a refusal among the laboring class composed of the small wage-earners, and in a few hours' work on one day more than thirty-five hundred dollars was raised, and practically all of it in dimes from the poorer

people. These people are not on the list of any charitable organization as supporters of charity.

We are, I might say, almost continually besieged by fraternal organizations and others desiring to give benefits and entertainments for the association—benefits of various sorts. Some of them have been accepted in the past, but the returns have been so meager as to lead us to discourage from the start any sort of effort in this direction. In going into an undertaking of this nature, allowing the name of the organization to be used as a beneficiary, the probable expense should certainly be estimated in a very businesslike way, and the possible receipts estimated very conservatively, for in gate receipts there is many a slip. If 40 per cent. of the total receipt of the undertaking goes for expenses, there is 40 per cent. thrown to the winds. The money may not entirely have been given for the purposes of the association, but that claim will often be made by those who have helped in it. For the work of the Louisville association in a city of 250,000 I should say that nothing which gave indication of meeting receipts of less than twenty-five hundred or three thousand dollars should be considered in the way of a benefit undertaking.

As Mr. Steele indicated, special appeals for specific purposes bring a much readier response than a general appeal. It is my very firm belief that no organization should go before the public in a financial campaign asking for a large sum of money without a clear conception and a definite idea as to what that money is needed for, and some conception of how it will probably be spent. This may seem perfectly obvious, and yet it is a thing that is very frequently disregarded.

In preparing for new projects, of course, as far as may be ascertained, the questions should be asked, Will it pay? will it be worth while? And for continuing past appropriations, Has it paid and has it brought results? In some cases it is possible to say that results have been obtained. It is not always possible, however. I would like to mention from our experience just one or two of the things that seem to have paid with us and one or two that have not. We have been one of the organizations that has been forced to carry on a large amount of relief work because of the inability of the charitable organizations to do this work until within the last six months. The large amount spent for milk and eggs diet was without result except for the consciousness of having done a necessary and a merciful thing. There are so many other things that enter into the cure of dispensary patients that I think it can be fairly said that an expenditure for milk and egg diet generally does not produce results.

One-half of the cost of maintaining our dispensary is borne by the municipal board, which employs a physician in charge of the dispensary instead of the volunteer staff which has been doing service heretofore. This expense, although it is not borne by our association, might properly be figured in a budget or program of a local organization. The expense of this paid physician seems to have been fully justified in the growth of the dispensary, the patients feeling that when they came they would be looked after by one man continually instead of being shifted from physician to physician.

Frank E. Wing, Chicago: Within the time limits of this discussion, of course, it would be impossible to cover in the large the features of a program for a local antituberculosis campaign. In fact, the fundamentals have been so well stated that it would be quite superfluous to attempt to do so. What I have to say is based upon experience in three large cities, and bears upon that phase of the antituberculosis campaign which relates to matters of *relief for* and *increased police power over* the tuberculous patient.

I do not think I am misstating the experience of any of our tuberculosis workers when I say that one of the greatest obstacles in the way of realizing the beneficial results of educational propaganda is the inability to offer the "down and out" consumptive, as most of them unfortunately are, the reasonable means of actually practising the education which we preach. We have set up for ourselves the motto, "*No tuberculous patient uncared for; no tubercular injection uncontrolled.*"

Complete control of all tubercular infection, both actual and potential, is so closely linked with adequate care of the tubercular patient that the former cannot be accomplished until the latter is secured. There can be no complete control without adequate care, and care cannot be adequate without complete control. We are all agreed as to the fundamentals—hospital care for the fallen; sanatorium care for the falling; dispensaries and nurses, the finding stations, for both the fallen and the falling, and for the tottering as well; compulsory report and registration of cases, disinfection of premises, laws against spitting, protection of food-supply, thorough inspection, and control of houses and work-shops for the sake of those who sooner or later may otherwise begin to stumble. We advocate open-air schools and better ventilation of schoolrooms to prevent the children from falling.

We are accustomed to say that first, last, and always the program that will secure these requirements lies along the lines of education. While educational propaganda is of first importance, local societies must recognize that it is as a means, rather than as an end, that educative work holds its justification. We must guard against accepting the fallacy that education alone is sufficient,

unless it attempts to educate those public and private agencies charged with the care and relief of the consumptive, as well as the consumptive himself. Otherwise we will be doing for the poor consumptive just what we would do for one who is starving, if we should lead him to a well-filled but padlocked storehouse, and say to him, "There is food inside; go in and help yourself." We should not forget that the door is closed and locked, and that the sufferer neither has the key nor the strength to use the key if he had it.

This leads me to the main point which I would like to bring out, namely, that our program of education must aim to secure generous and sympathetic relief, both public and private—in institutions and in the home—before we can hope to see large results in reducing the mortality from tuberculosis or in the control of the tuberculous. *If* it is a fundamental proposition that the only method of checking the spread of the disease is by hospital care of the advanced case, it is equally true that the hospital must be made so comfortable and attractive that the patient will be glad and willing to enter it. Our present difficulty lies in persuading such patients to enter the hospital. To one knowing the conditions in most of our hospitals for advanced cases it is by no means strange that patients refuse to enter them. Even if we had police authority in such cases it would be a manifest injustice to a great many self-respecting and hitherto self-supporting people to force them to submit to many of the indignities which most hospitals impose upon them. Most public hospitals for consumptives are deficient, not only in construction, but in the kind and quality of food and medical and nursing care given. *There has as yet been established no standard of care and treatment for this class of patients.* The enforced spectacle of death in the wards is to be deplored. As modern a building as the one recently opened in a western city, with its 325 beds and with its "quiet" rooms on every floor, cannot avoid it. In a hospital of 325 or more advanced patients, with four or five deaths every day and the death period often long-drawn-out, or coming on suddenly without warning, it is impossible to provide "quiet" rooms for every case. Yet, because of the existence of "quiet" rooms, other facilities, such as screens, have not been provided. Dying cases still remain public. I recall the case of a young girl, persuaded with difficulty to enter the hospital, who, when received, was placed in a bed between a dying patient on one side and one mentally deranged on the other. No wonder the girl left the hospital the next day and that no influence can persuade her to return. The spectacle of four bare walls, the careless attendant, the little attempt at medical attention—all these make the hopeless case still more hopeless and add to the difficulty of getting the patient to a point of willingness to enter the hospital. From a purely medical point of view, larger

expenditures to make the hospital a pleasant place in which to live may not be justified; but in the absence of police power to force the patient into the hospital it is not strange that a majority of patients go there only as a last resort, and that the greater part of the advanced period of illness is spent in the home, with the resulting danger of infection to the rest of the community.

I recall an instance last summer when one of our nurses found a dying patient in a lodging-house over a lunch counter restaurant. It was a hot summer day. The patient was expectorating freely and with no control. The windows of his room and of the restaurant below were open and a swarm of flies was flying back and forth from the patient's bed to the food laid out on the counter.

Local societies should make it a part of their program to create a public sentiment that will demand better care for advanced patients in hospitals, in order that they may be willing to enter; and then, but not until then, demand the exercise of wider police power in the case of those who refuse to go. Pending such reform and pending increased bed capacity to enable the hospitals to handle all the advanced cases, the majority of cases, during part, at least, of the infectious period of the disease, will have to be cared for at home. This involves another difficulty. By the time that most patients have reached the infectious stage they have become a community liability. With income cut off, the family is no longer able to stand the strain. Consequently, it becomes one of the serious problems which the nurse and the doctor have to face as to how to provide for the patient in such a way as to protect the community, as well as the other members of the family. We all know the weakened moral and mental fiber of this type of patient. We are constantly experiencing the difficulty of getting him to take the necessary precautions in the care and disposal of sputum, even after he has been thoroughly instructed. The patient demands some visible and material encouragement to give him the stimulus to do this. He goes to the dispensary, and the doctor tells him he should have certain kinds of food which he is unable to buy. He tells him that he should sleep in a bed by himself, but he cannot offer him the bed.

If it is fundamental that the advanced patient must carry out instructions faithfully at home and must isolate himself and his infection from the rest of the family, it is also true that he must in some way be provided with both the means and the encouragement to carry out this treatment. Private relief agencies, if not slow to recognize, have at least been slow to administer to the home needs of this class of patients. Public charity has seldom seen beyond the perfunctory relief of necessities. Private charity has been forced to

raise the question as to whether hopeless cases are proper recipients of its benefactions. The question of past history, willingness to submit to a prescribed plan, existence of relatives or friends who ought to, but who will not, help, have sometimes been made reasons for refusing aid. I am ready to admit that these are grave questions and that, from the standpoint of the individual, there is apparent reason to fear pauperization of the patient's family. But it is not for the individual, but for the good of the community and its protection, that the responsibility of the relief agency exists. The safety of other members of the family is often at stake. Failing to see the helping hand which he has been looking for, the patient is apt to lapse into a state of indifference, and soon becomes a hard subject to control.

I am not criticizing relief agencies; they are as generous as their funds will allow. If it is necessary to discriminate, of course, the discrimination should be in favor of the most hopeful case. My chief contention, and I am led to believe that it is an important one, is that adequate relief is the greatest factor in securing complete control. Of course, that relief should be provided ultimately from public funds, but until such is the case, the burden rests upon private charity. As a means of securing this ideal, local societies should carry out such educational propaganda as will educate public officials, private charities, and the entire community as to the importance of such a generous relief policy.

Dr. W. C. White, Pittsburg: It seems to me that one of the greatest weaknesses in tuberculosis work is the lack of business principles, the lack of a business basis upon which to build. In preparing a budget of any kind, whether it be for the British Empire or for the Tuberculosis Committee of Punxsutawney, it becomes absolutely necessary to know first what you are starting out to do, and many who are engaged in tuberculosis work do not grasp and accept this proposition. Yet it is absolutely true that what is desired is to make Louisville, or Brooklyn, or whatever place work has been started, the most perfect exhibition of what can be done for the control of tuberculosis, not only in that city or in that State, but in the world. There are few cities that I know, except Pittsburg, that can give you much more than the death-rate. They can give a fair estimate of the number of cases of tuberculosis, but they cannot give an exact stock-taking of their city, and I believe the first money raised by any organization and expended by any organization can well be expended in a stock-taking of their city—to determine the actual number of tuberculosis cases which they have to deal with and the state of each one of these cases, of the number of people exposed, of the number of sources of infection existing in the houses in the city, etc. You may say

that that is impossible for a volunteer organization. I can say it is not, because it has been done in the city of Pittsburg. It is absolutely necessary, of course, to get the backing of the law, of the public health office, and to get the control which comes from the backing of the law and from the officers of the city; and it is just as easy and far easier probably in a small community than in a larger community. If it was possible in Pittsburg, with such rottenness as has been thrust upon us in the last year or two, I can only say that it ought to be possible in almost any city, and it was consummated in Pittsburg in the midst of all the rottenness that has existed there. It was made possible by the work of a volunteer organization in securing the establishment of a tuberculosis commission. On this was correlated in the public health department of the city the activities of the State Commission on Tuberculosis, the city health department, and the volunteer tuberculosis association. The various activities of these formerly had been overlapping, with a consequent waste of energy. There were representatives of each one of these organizations on the commission which sits in the Board of Health for seven years. They were given five nurses with police authority. These nurses were sent on a house-to-house canvass covering two-thirds of the city, and inquiries were made in one house as to the residents in the house immediately next door and in their own house, and so we turned up 5000 unreported cases in two-thirds of the city of Pittsburg, 73 per cent. of which were in need of care and in need of help of some sort. I believe that this is the basis upon which every city must build up its work, and I believe that not until such a step has been taken, and until it has the backing of the city authorities, can any adequate arrangement of municipal efforts be arrived at to overcome this scourge, which has its center in the municipality and must be fought in the municipality. I think that this must be done not only by every city, but by every municipality and by every county, and I believe that it can be done by the volunteer organizations working there. I believe that only when we get in volunteer organizations men who take this breadth of view and adopt this procedure of centralizing the tuberculosis work in the health offices of the municipality on a business basis, can we arrive at what is best and most efficient in the management and control of this disease.

Dr. Butler, Cincinnati: I am very much impressed with what Dr. White has said. I think it is the key-note. First, find out what the situation in your city is and see what you have to combat. I had the pleasure of visiting Dr. White and seeing his work in Pittsburg, and I was very much impressed with what is being done there, and brought home with me many practical ideas which we are applying in Cincinnati, with splendid results.

But in forming a budget I do not know that we can always lay out just what we want to do and what the cost of doing it is going to be. But this matter can be put down as an axiomatic fact, that you cannot get too much money. The important thing is to raise the money. You can always use it. The greatest temptation is to go too deeply into relief work. The sympathetic cord is struck so deep that the temptation is to get too far away from the question of prevention. I am not one who does not believe in relief work, I think, if I have any temptation, it is to go along that line too much myself. But prevention is the thing, although I think the two, prevention and relief, can be worked very well together. The idea of doing educational work, and what to do and how to do it, is wonderfully helped by having some little experience in the relief situation, in the study of what the needs of a city are and the suffering of the people, and just what individual and different circumstances require. And so, on the other hand, the educational work brings stronger appeal for relief, and we can accomplish very much by relief work and by getting the cities to do more toward educating the people. Sometimes the only way to accomplish results and get the necessary relief work done and the proper interest from the city in it is through the educational work. Consequently work along educational lines is one of the first and most important things. Of course, you may take the physician, and a patient comes to him and the physician sees that he is not suffering from any ailment and says to him, "All you need is a little exercise and a little more fresh air and no medicine." The doctor well knows that that patient will probably leave him and go to another physician across the street who will prescribe for him, and he will pay some money for some pellets in an envelope or something in a phial that he can put in his stomach, and the patient calls the first physician a poor one and the second one a good one.

We should devote our energies to the educational side. The people do not appreciate the work that is being done unless you show that you have done something. If you can show in your annual reports that you have had so many cases to contend with and have done something with so many, and something else with so many others, that is something concrete. They will then respond to your appeals when they would not give you much to go and expound the doctrine of prevention, and you cannot in your annual report say "we have prevented so many people from getting consumption," and consequently you cannot get credit for the work done. But the two work together very well, and in Cincinnati we have, I think, gained a great point for educational work in getting the administrative control of our city dispensary. The city pays a part of the expense of the dispensary and we pay a part. The

city pays for a part of the trained nurses and we pay for the other, and the city pays for part of the medicines and we pay for the milk and eggs for the relief of the patients. The city pays the rent and we pay for the fuel and for lighting and equipping the building. We pay an instructor and nurse. We have found that the most valuable work, from every standpoint, that we have ever undertaken is this school nurse work. We have employed as an instructor a trained nurse that can go to the children and command their attention, and that educational work is doing more good and is meeting with more response in the hearts of the people than anything else, and the remarks that are heard on every side show that the work is taking effect and is productive of good. Our traveling exhibit is another very strong thing. We have an exhibit, ten by twelve, and we keep it two weeks in each place. The first day the attendance is about 800 to 1000, and the second day about 700, the average being about 350. We also pay a newspaper writer ten dollars a week to work up news features for the Sunday papers, and keep such information before the people in dollars well spent, but I don't know but what our trustees are going to cut it out, as they do not seem to appreciate it.

Dr. C. H. Johnston, Grand Rapids: I take it for granted that some of the people present to-day are from smaller cities than those already told about, and I want briefly to mention what we have done in a city of 100,000, where we would not be able to get a large amount of money together and pay a fifteen-hundred-dollar secretary. In our five years of work we have never had a secretary. We simply got together five years ago and formed a society, being the first one organized in the State, and as we needed money, we borrowed it until we got four or five hundred dollars in debt, and then we hired a paid Y. M. C. A. solicitor to solicit funds, and we got two thousand dollars in that way. In the mean time we were creating public sentiment, so that at the end of two years we got the common council and the board of health interested. We then got an appropriation for a sanatorium, which we have been maintaining now for three years. During that time we have treated 350 patients. We had accommodations for 30 or 40, but since that time the project has been enlarged considerably, and it all started with the work of our antituberculosis society five years ago. We have unloaded on the city the sanatorium end of our work, and when I left home a week ago we had five late cases waiting to get into the sanatorium. During this time the common council had given our board of health police power, so we can go to any advanced case in that city and say "Now, come with us to the sanatorium," and we can take them—sometimes a whole family. We have removed to

the sanatorium as many as five people all of one family, all of whom were affected with tuberculosis. And the society is relieved of that expense.

We are now keeping a dispensary and have a nurse whom we pay fifty dollars a month, and our budget for the nurse and dispensary and our advertising work now is about one thousand dollars a year. We have created a public sentiment that has compelled the erection of the sanatorium, and while we still conduct our dispensary, in a short time we expect to unload that part of the work on the board of health.

Chairman: Dr. Johnston, did I understand you to say that under a municipal ordinance you have compulsory removal powers?

Dr. Johnston: We have had for two years.

Chairman: Is it an ordinance of the city?

Dr. Johnston: Yes, sir.

Dr. Theodore B. Sachs, Chicago: The first investigation of prevalence of tuberculosis in some of the congested districts of Chicago was made in 1902; this was followed four years later by a reinvestigation of the same district and the surrounding territory. The first investigation covered the prevalence of tuberculosis in some of the river wards, with a mixed Jewish, Bohemian, Italian, etc., population, in a territory of 244 acres; in all, 677 cases of tuberculosis in a population of 31,000 were recorded in a period of eighteen months (May 1, 1902, to November 1, 1903). A house-to-house canvass, accompanied by examination of all suspicious cases, was made in a block noted for its congestion and unhygienic conditions. Miss Hazard, a resident of the Hull House, assisted me in this house-to-house investigation.

In the reinvestigation of the larger district (444 acres), 1252 cases of tuberculosis were recorded in a population of 57,589 people, in a period of two years (January 1, 1906, to January 1, 1908).

Charts, various data, and articles bearing on these investigations can be obtained from the Chicago Tuberculosis Institute.

This work antedates, of course, the Pittsburg investigation to which Dr. White referred, and which is so essential in the formulation of measures directed against the white plague in any city or town.

I was very much interested in the paper of Mr. Jenkins and the discussion participated in by the secretaries of the various tuberculosis societies; it would be impossible to cut down these budgets at a time the bulk of the entire tuberculosis work is being carried on by voluntary organizations, and still we all know that a large portion of it falls within the province of official agencies.

We all agree with Mr. Wing in considering the care of the advanced consumptive a crucial problem to be solved in justice to the community and the

patient himself. It pays to give the advanced consumptive all the necessary comfort, medical attention, proper diet, etc. The National Association for the Study and Prevention of Tuberculosis would do well to investigate the conditions existing in various hospitals for advanced cases in this country, and through study and discussion arrive at a uniform standard of minimum proper requirements applicable to such institutions. A symposium on this subject at the next annual meeting would tend to raise the standard of such hospitals all over the country.

The advanced consumptive, receiving in a hospital a proper diet, reasonable amount of attention, and medical care directed to relief of symptoms, etc., is generally willing to stay, and this means a great deal to himself, his family, and the community at large. We certainly have no normal right to compel him to live in an institution in which he is neglected.

It must also be remembered that with proper care a percentage of moderately advanced cases—and even far advanced—get not only in good condition, but recover a variable degree of working capacity.

A great deal is being done for the incipient tuberculosis case, and a great deal more should be done; comparatively little attention is paid to the advanced consumptive, and in justice to himself and ourselves we must resolve to do all in our power to raise the standard of care accorded to him.

Frank H. Mann, New York: I just want to describe for your information a practical method of raising money to support tuberculosis exhibitions. I suppose that the exhibit is one of the most useful features of education that we have, and in our exhibition in New York we have been able to pay all our expenses by putting a collection-box in various places throughout the exhibit. We have an ordinary tin bread-box with a slit at the top for the money to drop in, and double red crosses at the end. And we are able to collect about seven dollars a day in voluntary contributions in the boxes. No effort is made on the part of the manager of the exhibition to get anybody to contribute. The box simply stands there, and they drop the money in as they pass. About 85 per cent. of the money that we get in those boxes we get in dimes or less, so that you see it is probably the laboring class that drops in the small coins as they come into the exhibit. We get on an average about six cents from each person that contributes, and an average of about one-tenth of one cent from each person who visits the exhibit. I do not see why every exhibit in every community should not pay for itself. Our exhibit costs us about two thousand dollars a year; the manager gets twelve hundred, and then there is the expense of moving, the expense of lighting, and other incidental

expenses amounting up to that sum. We are able to pay all the expenses, and have a little surplus by the use of these contribution boxes.

Dr. R. H. Bishop, Cleveland: There is an item which seems to me should not be omitted from any budget, and that is an item to cover the expense necessary to the education of the secretary in taking up the work in any community. I began the work in Cleveland last July. I had had a medical training and a certain amount of social settlement work, but after I had been in tuberculosis work for six or eight months I soon found that I was all at sea—I did not know how to go about it—I had reached my limit. So I went to my Board of Directors and told them just how I felt, and they immediately voted to give me an appropriation of two hundred dollars to travel around and see what was going on in other places. I came back with a great many new ideas and very much enthused. I immediately got in touch with the health department, and the health officer said he was willing to do everything he could, but he did not know a great deal about it. So we placed the matter before my Board of Directors and they voted one hundred dollars to send our health officer on a tour of inspection. In addition to this we sent our head nurse to New York and Boston to look over the work there, giving her one hundred dollars for that purpose. So when we all reach home and get to work again we hope to accomplish a great deal.

Dr. Mary Gage-Day, Kingston, N. Y.: Our city has a population of 25,000, and our committee is not quite one year old. Last May the State Charities Aid Association and the State Department of Health sent the tuberculosis exhibit to Kingston, and when their representatives examined our health records, it was discovered that our death-rate from tuberculosis was the fifth highest of any county in the State of New York. A local committee was organized, and from all the education that the public had received from the exhibit we found that the people expected something from us, but we had no funds. However, as the needs of the community were great, it was decided to try to raise some money by having a tag-day. The committee was just organized; we had neither funds nor experience, so we were obliged to go ahead and do the best that was possible to work out our own salvation. The proceeds of the tag-day amounted to a little over four thousand dollars, and it was decided to build a camp. Benevolent people had donated the use of an excellent site. The camp cost about two thousand dollars, and is constructed of cottages and tents. The rest of the money was kept for maintenance.

The work was so successful during the summer that it was decided to continue it through the winter, and it became apparent to all that a hospital build-

ing should be secured for the advanced cases, the idea being to have an inexpensive building and private rooms, with wide doors, so that the beds could be pushed out on the wide porches. In order to obtain funds for this building letters of appeal were sent to persons who were known to be able to respond. About three thousand dollars in all was received for the building, so these results corroborate the remarks of the gentlemen who brought up that method of raising money.

The ground was broken for the hospital building the first day of November, 1909. The experience gained in the work since the time of organization the preceding May had made us all realize that exterminating tuberculosis was too great a problem for any volunteer committee to manage, so application was made to the county board of supervisors to establish a county hospital under the law of 1909, which was passed in New York State.

The official powers of the board of supervisors said they would not establish a county hospital and make a "political job" of it, as they called it, but if there was any way they could enter into a combination with the committee they were willing to appropriate some money for this purpose. The president of our committee is a lawyer who is much interested in the work, and he thought out a plan by which the county board of supervisors appropriated six thousand dollars, and the committee entered into the arrangement and supplied the rest of the funds; the supervisors appointed as the first board of five managers the president and the secretary of the committee and the chairman of the hospital subcommittee, the other two being members of the board of supervisors.

Ulster County now has the following equipment for the care of tuberculous patients:

A camp on four acres of ground, well located, with tents and cottages for the care of the incipient cases, and patients were kept in these all through the past winter. A hospital on camp grounds which was opened for public inspection a few days ago, April 29th. In the hospital building there are administration rooms, dining-room, kitchen, laundry, and ten private rooms for patients, making our total capacity about 30 beds. We plan to take care of all classes of patients in this institution. We expect that many of the incipient cases in the tents and cottages will recover. We believe that if we take care of the advanced cases, who cannot care for themselves, although they do not recover, the infection is not spread over the community, but is destroyed, and we hope by such precautionary measures that the death-rate in our county will eventually be lessened.

Our committee will be one year old the last of the present month. We have never had a paid secretary, and no other member of the committee has

ever received monetary compensation. The work accomplished has been done largely by busy men and women, who have still devoted some of their thought and time to the work of alleviating human suffering.

Severance Burrage, LaFayette, Ind.: I come from a still smaller town than that represented by the last speaker. Probably our present census will run up to 22,000, and some are hoping it will be larger. We have had a tuberculosis society for just two years. It has been regarded as a very active little society, having about 150 members. We have had the State tuberculosis exhibit there for three days, with an attendance of over 5000; we have had public lectures; we have published notices in the newspapers; we have given lectures in the university which is in the town, and have adopted various other means of educating the public. We have been hampered by one factor, and that is a lack of interest on the part of the physicians, and we do not seem to know how to work that out. The tuberculosis society has an active executive committee, the work of the society being done by two or three men. These are active workers. The executive committee had an offer from the Red Cross Society, which raised funds by the sale of stamps, to build us some shacks. We wanted to accept that offer. The executive committee invited all of the physicians in town, 50 in number, by personal letters from the president of the society, to attend a meeting with the executive committee. Out of the 50 physicians we had just one in attendance. We have had other instances of lack of interest and active energy on the part of physicians, and we do not know how to awaken that interest. The idea of Mr. Bishop is certainly an ingenious one, and if we can raise five thousand dollars and send these physicians away on a junket at one hundred dollars each, I think that possibly might awaken their interest; but I do not see where the money is coming from. There is one point in Mr. Wing's discussion and one or two others that mentioned the hospital for advanced cases. We have been discussing that a great deal; but we find that in bringing the discussion before the public it is advantageous to call it a *home* for the advanced cases rather than a hospital. If we call it a home or some other name that does not suggest the idea of a hospital, I think it proves of great advantage, and in our discussion in regard to that matter we would call it a sanatorium for the curable cases and a home for the advanced cases.

Mrs. William A. McGraw, Detroit: A successful mode of raising money was that followed by us in Detroit. We named a certain day, June 9th, for an annual collection for antituberculosis work, which we called "Tuberculosis Charity Day," and we have been able to work up great interest

among the people in the celebration of this day. It is looked forward to as an annual affair. In 1908 we collected $12,920, and in 1909, $14,240.

We begin a campaign of organization about four or five weeks before the day, appointing and organizing committees, conducting during that four or five weeks a campaign of publicity, to which the press of the city has always responded most cordially and generously. We consider their support as one of the most important factors in our work. In a spirit of hearty coöperation and good will there would be scarcely a limit to the splendid results to be obtained under proper organization. The work is most interesting, including educational features, useful and gratifying; it gives opportunity of distributing valuable information in the form of posters and folders in public and parochial schools and factories, also in churches. I have had the honor of being chairman of the executive committee for three successive tag-days, and speak from experience.

There was a public demand for the work of visiting nurses, and we considered it a good type of educational work to employ several nurses and to make it possible for them to do a certain amount of relief work in the distribution of milk and eggs, giving alcohol baths, etc., thereby making it possible to gain the confidence and interest of afflicted families. In 1909 seven nurses were employed.

Twenty-four hundred dollars of the fund was given for a pavilion and its furnishings on the city hospital grounds. Five thousand dollars started the subscription to a sanatorium promoted by the Detroit Society for the Study and Prevention of Tuberculosis, and the sanatorium is now in process of erection.

Great interest has been aroused in our work through the educational propaganda, and we have reached a point where contributions are being made for the work of the society. A tract of land, valued at $12,000, was given as a sanatorium site. Very soon after that a firm of well-known architects generously offered their services, and a landscape engineer offered his services in properly laying out and planning the grounds of the sanatorium.

It would seem to me, Mr. Chairman, that this plan of organization for a day of public collection might be adopted elsewhere, with both profit and pleasure. Results in Detroit have certainly proved the plan to have been valuable.

Mrs. F. M. Perkins, Brooklyn: We find that the use of the word "home" does add greatly to the willingness of the patient to enter the home, and while the Brooklyn home is not doing all the work we feel it could do, still it is taking care of advanced cases,—a great many of them,—and we

find a great willingness to come into the home when they probably would not go into a hospital.

Dr. Hope, Philadelphia: I just want to say that the text this evening seems to be the question of raising the angel—how it shall be done. There are so many points of view that I think any of us could have something to say on this subject, but I think we had better stick to our text as near as we can. To get the gold of a very rich man will be the most convenient method and the easiest—or a rich woman will do just as well. But if you can enlist a large number of people, you will fulfil our task of educational work. I think we ought to remember that the red cross stamp day originated in Wilmington with Mrs. Bissell, and we can thank that lady for a great many convenient methods of raising money, and it has been very profitable for our tuberculosis work. The tag-day has been used in Philadelphia for the playground work of the city, and while I think the tag-day idea is a very good one, I think it has been preëmpted in certain quarters. The work of establishing large hospitals and large sanatoria I think to a certain extent is limited, as far as our society is concerned, because it belongs to the community, and I think we ought to shelve as much of that sort of work as we can off on the public at large, and give to the municipality the care or the far-advanced cases. It is absolutely necessary that they should be taken care of, and there is one point I want to lay particular stress upon, and that is that in any community where those far-advanced tuberculosis hospitals are established the proportion of deaths and cases of tuberculosis decrease; that is very essential, because you will find that there is a great deal of public sentiment against it. So much so that in New Jersey recently they had great difficulty, and in fact did not succeed, in establishing a hospital in Lockwood for which they had an endowment. When it has been proved that such hospitals are not a source of danger, as has been done in Germany and different places, then this feeling against them by the public will disappear. I live within two squares of such an institution, the oldest in the world, and I am sure that the community has not suffered. I might say that at first the value of property did suffer, but that has gradually passed away, and I am now able to show by statistics as to the cost of property sold in the neighborhood that it has not decreased very largely, and that the purchases of adjoining property within the last ten years have been by families who knew the conditions, and, consequently, I think we can overthrow their arguments against it, if we only have a chance.

Dr. Albert, Alexandria: In regard to the question of raising money, it is a fact that you can get private money in abundance for anything that is new and startling, and cannot get it when the question gets

old and stale. Public money is exactly the opposite of that. For anything that is new and untried you cannot get a cent, but for anything that has been tried you can get it. Now the tuberculosis movement is getting to the stage where it is getting difficult relatively to get as much private money as you need, whereas if you strike for public money you can get it in greater and greater abundance. Therefore, we must turn our energies from begging money to voting money. I am glad to see that so many of the speakers have spoken on the subject of getting the cities to do more, and this idea should be pushed in the educational campaign, and when a voter is approached for money, he ought at the same time to be approached for his influence. When you ask him for his occasional dime, or his annual dollar, or for his thousand or million dollars, you ought at the same time to ask him for his influence for legislation, and not so much for the prohibition legislation that we have been getting, but legislation to help the consumptives of the country.

THE QUESTION OF EMPLOYMENT

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The purpose of this paper is to call attention to the importance of a continued and more active interest in the problem of employment, not only in institutions, but also as applied to patients after their course of treatment. In addition to this, it is true that the best preventive work is that which will result in an improvement of general working conditions.

At present, periodicals are full of discussions of the so-called movement back to the land, and men like J. J. Hill, Governor Hadley of Missouri, and others have lent their interest to the discussion.

The proper handling of this problem vitally concerns our work and it should receive the active interest and co-operation of all those fighting tuberculosis.

With the development of large public sanatoria it is only natural that the question of employment for patients while in these institutions, as well as after their discharge, should assume much importance.

For a long time the question has been considered in connection with institutions caring for other sorts of dependents.

Prisons, reform schools, insane asylums, and institutions for epileptics and the feeble-minded have taken up the question, and in isolated instances much success has been met with. But with the curse of politics and the lack of intelligent public interest and support little real progress has been made except in isolated and exceptional cases.

Progress along this line should be much more rapid in our work. There seems to be a marked awakening of public interest in sociological affairs, and this, with the enthusiasm engendered by the antituberculosis crusade, is bound to produce results.

Heretofore all that society has done for consumptives was to provide for their burial, and possibly to hasten the end of their suffering by carefully shielding them from fresh air. And until our present machinery is much

more elaborate and perfect, probably the net results of our efforts will be only to lengthen the average duration of the disease.

The campaign, as outlined in most communities, contemplates the continuation of the educational program, the elaboration of the dispensary and sanatorium, and, above all, the care of all advanced cases in hospitals. The nearer we approach this, however, the more we realize that the plan requires further elaboration.

In communities where well-conducted hospitals are provided no difficulty is found in filling them. However, it is generally noted that as soon as the patient's symptoms have abated and his general condition is improved, he becomes impatient to return to his work. Either this, or he develops into a confirmed drone, and has finally to be kicked out to return to the competition of life, unfit morally as well as physically.

This situation does not work hardship on the individual alone, but adds very materially to the burdens of the charitable organizations coöperating with the hospital. The problem confronting the relief organization when a case is to be sent to the hospital is usually quite serious. As a rule, it means that the household must be broken up and the entire family readjusted. Any arrangement attempted by the family is usually a change for the worse, and this time is the best for readjustment. If the father is the victim, as a rule, the mother must be found employment and the children found homes. If it is the mother, then again homes must be provided for the children and the household broken up. If it is one of the children, as a rule, conditions in the home are found to call for a radical change. Now the point is this: often these changes are carried out and the various relations satisfactorily adjusted, only to be upset by the return of the patient. As this is usually contrary to the advice of the authorities of the institution and the charity workers, the patient and the family take matters in their own hands, and soon conditions are worse than before.

Of course, this is by no means the invariable rule, but undoubtedly in dealing with advanced indigent cases under present conditions such results are only to be expected.

At present there is in most institutions a rule refusing readmission to patients, and thus, as far as the institution is concerned, the problem is settled. Then, too, as yet the problem, as a whole, has not been attacked, and each group of workers has done everything possible, and necessarily left its failures and the work beyond its scope uncared for. In fact, it may safely be said that as yet no comprehensive solution has been found.

It would seem that one thing is certain, that it is impossible to expect the

advanced and in many cases the moderately advanced consumptives to enter into the fierce competition in our modern communities. It is true that there are certain isolated trades and callings where conditions are such as to give the patient a fair show. But unless these conditions are present, it is very wrong to abandon the patient to his fate.

Of course, it goes without saying that in many instances industrial conditions are such as to call for radical reform. A great deal of our energy should be directed toward improving housing and working conditions and hours of labor, but this would only result in increasing the number of cases who could safely return. It will still leave a large number who, without special aid and supervision, must fail.

Heretofore in many cases the patient has attempted to change his conditions, but in a large proportion of cases failure results. The chief idea has been to secure outdoor employment. Now, when this is done, the patient either receives a lower wage, and is thus thrown into less desirable home surroundings, or the work done requires so much greater physical strain that relapse ensues. Undoubtedly, under intelligent supervision, better results may be obtained. The Jewish charities of Cincinnati and Louisville have adopted the policy of setting their patients up in some business, such as laundry agent, collector, restaurant keeper, etc., where the conditions are such as to insure the patient a fair chance. Undoubtedly this plan, just as that of allowing the patient to seek unaided employment, has its limitations. The artificial shifting of employment will overbalance conditions and cannot be applied to the vast number of cases to be considered.

On the other hand, Dr. Lyman has recently found, in analyzing the records of the discharged cases from the Gaylord Farm Sanatorium, that those cases do best that return to their old employment. This statement by no means settles the question, however. Dr. Lyman's patients may be said to belong to a class above that of the average, or at least above the great number below the poverty line. As a rule, either the patient or his employer pays seven dollars for his maintenance in the institution, and this means that his home surroundings and working conditions are or can be made fairly suitable. Under these conditions the patient may be able to modify his home surroundings, and there is an excellent chance of persuading his employer to modify his working conditions. But this does not take into account the great number of cases where either the working conditions or the home conditions or both are such as practically to make relapse certain.

Granting, however, that these two plans are properly developed and that

advantage is taken of one or the other wherever possible, the very large number of cases unprovided for must be helped in some way.

At present the only plan which gives much promise is some form of colonization. We know that migration is constantly going on, and that it relieves congested conditions, and that, as a whole, it tends to work for good. As yet, however, such movements are little understood, and very few efforts have been made to guide them intelligently. The movement to our West and across into Canada, and the immigration into this country from Europe, offer many valuable lessons which might be used to advantage in formulating plans for the proper disposition of consumptives. At least, it might be said that if these instinctive movements are successful, then it is to be expected that if the proper supervision is afforded, many of our consumptives can be disposed of in this way.

There still remain in the West large areas which, when irrigated, will produce an ample living with the expenditure of little labor or capital. And, furthermore, the climate in these areas is such as to afford the best possible chance of recovery. Whatever the merits of the claims made for climate, it may safely be said that in the cool, bracing, dry air of our West physical exertion can be carried on with a greater degree of safety than in the enervating climate of other sections.

Whatever may be the result of any such broad scheme as the above, its result necessarily depends on the organization which feeds it. Every case must be tried out and proved capable of understanding the work before so radical a change can be made. This will require a much more elaborate institutional system than is at present generally in force.

There has been in the last few years a most unfortunate and narrow criticism of various factors in the work. The sanatorium particularly has been criticized for a supposed lack of results. The visiting nurse too has received her share of criticism. It ought to be clearly realized, at least by those in the work, that so far no factor has been developed which is superfluous, and that slow progress is due to the inadequacy of our organization.

The machinery for discovering and treating patients is fairly well developed, although yet totally inadequate. But at this point the organization breaks down. We gather the patients to the dispensary through the visiting nurse. There they are diagnosed and classified, and then placed in the sanatorium, the hospital, or the home class.

When the time for discharge comes, the patient is suddenly released from rigid discipline and supervision, and even though he is still kept track of through the dispensary, he must fight his battle practically unaided.

Undoubtedly, Dr. Patterson's plan for graduated labor is a marked step forward in preparing the patient for his return to active duty. The régime in sanatoria has been tending in that direction, but Dr. Patterson's work has added marked impetus to the movement.

Always, however, the difficulty has been to find occupations offering sufficient variety of exertion to be suitable to different cases. It cannot be denied that agriculture offers the best form of employment. This is true on account of the great variety of the work, the interest which can be aroused, and the possibility of using unskilled labor.

It is curious that so little progress has been made in agriculture, the oldest of the arts of civilized man.

Scientific research has been directed along these lines in recent times, and wonderful results are being obtained. Popular interest also is following these results, and it is not hard to find proof of this statement. The trend of the well-to-do to the suburbs of our cities, and the interest shown by these people in their gardens and grounds, together with the great popularity of horticultural books and magazines, are evidences of this trend. So also are the farmers' and gardeners' associations, the agricultural colleges, the farm and garden associations among the children on the farm and in the cities. Institutions for the feeble-minded, reformatories, and penitentiaries in many instances have been very successful along these lines. It may be said that artificial movements of any kind cannot overcome natural obstacles. Nevertheless, if they are intelligently engineered, they may accomplish great good. It may even be said that all emigratory movements from the penal colonies of Australia to the settlement of our West have been artificially though crudely directed.

The point is that the tuberculous patient will more willingly lend himself to any such plan than the healthy individual. In the first place, the fact that he has developed tuberculosis is pretty good proof that he is unsuited for city life, and then, if he is properly trained while he is in the institution, he will learn that agricultural work is as pleasant and remunerative as his old occupation.

If he is kept under institutional supervision until he is physically fit and has developed sufficient skill and knowledge in his new work, he may be given opportunity to stand alone, with the best possible chance of success.

For the reasons given above institutions for the care of the tuberculous poor should be located near our large centers, on land capable of being brought to a high state of cultivation. They should not be so far away as to prevent the marketing of surplus produce.

The early and advanced cases should be in separate institutions, but should be on the same property and under the same general management.

In addition to the sanatorium and hospital, there should be a farm colony. To the latter institution should be sent all patients from the sanatorium and hospital whose cases are sufficiently arrested to allow continued physical effort. Medical supervision as well as institutional discipline should be continued, but greater freedom may naturally be allowed the inmates.

In the farm colonies not only quarters for the patients may be provided, but those for their families. In most instances, where the father or mother is tuberculous; the family must be supported by the charity organization, and with this plan it can be done most economically, and at the same time affording the greatest amount of comfort all around. It is safe to say that such a plan will lower the cost of maintaining patients to the lowest possible point, and if it is wisely carried out, may even be self-sustaining.

If the same ability and interest were applied in the conduct of such institutions as are applied in business ventures, there would be little chance of failure.

It might be objected that city patients could not be interested in farm work. Surely those who toil in the dingy factories monotonously day by day will find such work more interesting.

Then, too, it might be claimed that the lack of amusement during the hours of recreation would be a drawback. It is a simple matter, however, to provide for this.

Possibly the most serious argument that could be used is that in summer the enervating heat would prove a serious drawback. However, as eight hours' labor would be the limit, the hours could be so arranged as to avoid the heat of midday and, furthermore, the superheated stagnant air in most city factories and work-shops is just as serious a menace. To these and all other arguments I would like to point as an answer to the success of such a scheme as has been outlined.

Four years ago, at the Eudowood Sanatorium, the system of employing patients on the farm was instituted. Only incipient cases were admitted, and as soon as their condition warranted it, they were given tasks varying in length and effort, the object being to bring them up to eight hours' labor a day before discharge. About a year later the farm colony was established, and a small group of cases was transferred from the sanatorium and the scope of the work was enlarged. About a year and a half ago a hospital for advanced cases was added.

The institution works in close coöperation with the dispensary in the city, and also with charity organizations.

Owing to the lack of funds, the development of the work has been very slow, but it has certainly been highly successful from every point of view. The patients have lent themselves to the plan with the greatest interest and enthusiasm. The failures, either from a moral or physical point of view, have been rare. The farm has been self-supporting from the first. Patients from the hospital whose condition warranted it have been transferred to the farm and have been perfectly contented and self-supporting. There is not an idle moment during the year, and work is provided for men, women, and children. In one instance an entire family has been provided for for over a year. This family had been a problem for the charity organization for a number of years previous.

The sanatorium and hospital have been supplied with an ample and varied supply of produce at the lowest possible cost, and considerable surplus has been sold each year.

In spite of every conceivable drawback, the work has continued to expand.

If a similar plan were carried out in connection with every institution of the same size, a large number of graduates might be colonized in the West and self-supporting communities established.

If we remove the tuberculosis alone from the overcrowded centers, we will do much to relieve congestion.

We must amplify our work until we have an organization which provides for the patient in the so-called pretuberculosis stage, in the incipient, the moderately advanced, the far-advanced, the arrested, and even the apparently cured stage. Certainly the problem of work applies very directly to the first class. To all intents and purposes work and environment may be said to be synonymous, and if we can only raise the standard, we will be fulfilling the laws of prevention. We are, or soon will be, fairly well equipped to care for the incipient, the moderately advanced, and the advanced cases during the period of the activity of their disease, and during this period work is out of the question. But as soon as this activity subsides, it immediately becomes vitally important.

And, finally, with the arrested and apparently cured cases, where work is the all-important question, we are sadly remiss.

Therefore, it cannot be urged too strongly that we turn our attention to this, the weakest point in our work, and see that the proper measures are taken. I have learned in the last few weeks that the Federation of Jewish Women is to take up an investigation of this subject. In my opinion they

should not be allowed to carry out this great undertaking unaided, but should receive the active aid and support of this Association, as well as of every local organization in the country. Until such an investigation is made, it may be safe to draw the following conclusions from our past experience.

That we, as a part of our work, must aid every movement which will tend to raise the standard of living and working.

That every institution for the consumptive poor should be located near the large center it serves, but at the same time on arable land, so that agricultural work may be done by the patients.

That while various arts and crafts may be taken up, they have little practical value, and cannot be expected to afford the patients a livelihood after their discharge from the institution.

That in conjunction with sanatoria and hospital should be developed farm colonies where cases may, to a large extent, continue under the advantages of institutional care, and at the same time be either entirely or to a large extent self-supporting.

That our organization must be so strengthened that for every case we return to the community we find living and working conditions as nearly as possible insuring the continued health of the patient.

That through the government or with the aid of private philanthropy we make some effort to intelligently guide and supervise the movement of consumptives to the West, and to give those whose conditions warrant it opportunity to settle on arable land or to engage in some healthful occupation.

I should like here to pay tribute to the work of Bolton Hall. Undoubtedly he has done more than any one else to stimulate interest in the movement back to the land. His books have been an inspiration to me and I feel that the work he has done is vitally important to the success of the antituberculosis crusade.

DISCUSSION ON DR. FORSTER'S PAPER

Dr. William J. Vogeler, Yonkers N. Y.: Yonkers is a city with a population of 85,000, of which 35,000 at least are dependent upon the factories for a living. In order to solve the problem of dealing with the cases of incipient tuberculosis of the lungs that occurred among this class without pauperizing them, the Sprain Ridge Sanatorium was built, it being the original intention that patients be allowed to return to their work during the day, sleeping at the sanatorium at night.

This plan had to be abandoned, owing to the fact that patients did not

improve rapidly enough in the six months during which they were to be allowed to stay, and another was substituted which allowed them to be under strict hygienic-dietetic treatment for from three to four months, and then permitted them gradually to return to work. This again was found impossible in many cases, owing to the fact that the authorities in the factory and shops would not take on any employees except upon full time. We, therefore, thought it best to keep them in Sprain Ridge the regular period of six months, during this time getting them as soon as possible upon graduated exercise, so that upon discharge most of them would be able to do fairly heavy work. We then undertook to make a study of the best form of occupation for the patient in whom the disease has been arrested.

As Sprain Ridge draws all its patients from the immediate neighborhood, and as, upon discharge, the patients return to their work in Yonkers, we have had exceptional opportunities for registering results in this line. We soon found that in order to get the best results and the most accurate information, it would be necessary to keep in close touch with each patient; and for this purpose a club was formed, consisting of all the patients discharged, and modeled after the Pratt Tuberculous Class. This club meets the last Sunday of each month at Sprain Ridge. The object of the club primarily is to encourage the patients to meet socially and discuss all subjects bearing upon the cure of the disease, and receive advice from the attending physician and superintendent. Here records are kept of the occupation, hours of work, the condition of the home and factory, and the manner of living. The temperature, pulse, and weight are also recorded at each meeting. It is surprising how easy it has been to keep control of the cases in this way; those who do not come to the meeting are written to for information as to their condition, etc., and the records obtained have been very interesting, proving rather conclusively the point which we wish to make in this discussion, viz., that certain out-of-door occupations, such as motormen, conductors on trolley cars, caddies, drivers, etc., which would ordinarily be considered beneficial, have, from the long hours, irregular employment, and mental strain proved the reverse. On the other hand, those who have returned to their work in the factories have not only held their own, but in many cases continued to improve in weight and show improvement in their condition. Much of this is to be attributed to the coöperation of the owners, superintendents, and others in authority of the factories, several of whom we are fortunate in having on our Board of Directors, and whom we have impressed with the necessity of placing the patients under the best hygienic surroundings, near windows, etc.

Of those discharged from Sprain Ridge since its opening, two years ago,

over 50 per cent. have returned to the indoor work to which they had been accustomed before admission. If we omit the children, most of whom have returned home and are now going to school, from our calculation, this proportion is raised to 60 per cent., and if we further deduct the number of those who are resting and consider those only who are at work, we find that, of these, 80 per cent. are doing indoor work of some kind. Our records show that of those doing indoor work only a few have not continued to improve, while in those doing outdoor work 25 per cent. have shown a dangerous loss in weight or increase in their symptoms. These relapses were due to the fact that much of the outdoor work was more or less uncertain as regards hours and steady employment, depending upon the time of the year and the changes in the weather, and that the often enforced idleness had a tendency to make the men careless in their habits and harm them morally. We have also noticed that a number of the latter group who have been advised to give up the outdoor work, which was evidently doing them harm, and accepted indoor work with good hygienic surroundings, improved in their condition. Besides, if one thinks the matter over, it certainly seems more likely that a discharged patient will do better in a factory and at an occupation to which he is accustomed than if he were forced to learn a new trade; and if, as has been definitely determined, the first necessity for the patient's return to and stay in good health is good food and clean and cheerful quarters, it necessarily follows that if a patient is earning more money at his old work than at a new occupation to which he is unaccustomed (as he undoubtedly will), he will be much more able to acquire the proper food and healthy surroundings; and if his old employment, at which in some of our cases twenty-five years have been spent and the accomplishing of which has become second nature, means steady employment, good hours, good surroundings, without the nervous strain incident upon such outdoor employment as driving, conductor on the running board of a summer car, surely it is the best for him. We have, therefore, been advising all of our discharged patients to return to their old work, provided it is not distinctly harmful.

Dr. C. P. Wertenbaker, Norfolk, Va.: In the fight against tuberculosis it has become evident that the great mass of the poorer classes suffering from the disease are not being reached effectively.

One of the great obstacles in the path of eradicating tuberculosis is that only the largest number of consumptives is among a class of people who depend upon their daily labor for their bread. Many of these people, either from poverty, environment, or the necessities of their labor, or from stupidity, carelessness, or indifference, are unable to put into practice those principles of sani-

tation that are necessary to protect them from disease. The "*unteachable*" consumptive forms a large class, but it is small when compared with that formed by the "*unable*" consumptive. Let the reason be what it may, the fact remains that a large number of consumptives do not take the necessary precautions to prevent the spread of the disease, and until some means is devised to care for this class of cases, it is useless to hope to solve the tuberculosis problem.

One of the chief difficulties in the way of effective work is that there are not enough places to receive the consumptives who wish to go to them. Every sanatorium that gives free treatment is not only crowded to its capacity, but has a long waiting list of applicants.

The number of consumptives is so large, and the cost of their care and treatment has been, up to the present time, so great, that it has been impracticable to provide adequate facilities for them.

The only practical way in which this great army of invalids can receive the necessary care is for each community to provide for its own cases. This is attacking the problem in detail, and, consequently, with probability of success.

However, in order to do this it will be necessary to provide some means whereby the cost of this work shall be kept at a figure that will be within the reach of every community. It is proposed to show here how this can be done.

The Plan.—1. The establishment, in each community, of a farm sanatorium where tuberculous patients can receive care and treatment; these farms to be conducted on modern scientific principles, under the direction of a practical, trained agriculturalist, with the view of operating the farm as a business enterprise, the products being applied to the support of the patients. The farm to be operated by a regularly employed force of *healthy* farm laborers, and not by patients. The expenses for the care and treatment of the patients, exclusive of the food which is to be supplied by the farm, should be defrayed by the city or town.

2. The farm should be located near the territory from which the patients are to be drawn, preferably on the line of a trolley or railroad, within easy distance of the city or town, for convenience of access and to enable patients to have visits from their family and friends.

3. Suitable buildings for sheltering the patients should be provided. The medical care and treatment of the patients should be under the direction of a physician who should reside on the farm, or make daily visits to it. Cities and towns having a health department could operate the farm sanatorium as

an adjunct to the health department at little or no increased cost for medical attendance.

4. Patients can be allowed to do such work as may be permitted by the physician in charge. This work may be duties in connection with the farm or sanatorium, or it may be work that has been especially provided for them.

5. For all such regularly assigned work *each patient should be paid a specified price*, the amount earned being credited to him, and he should be allowed to draw the money at his pleasure. The scale of prices paid patients would have to be determined by circumstances, but a tentative basis of 10 cents an hour, or at that rate for piece work, is suggested.

This plan can be carried on in connection with the agricultural experiment stations now in operation in many States, and farms connected with almshouses and other institutions can be adapted to it, as well as at a regularly constituted farm sanatorium.

There seems to be no reason why farm sanatoria operated on this plan should not be successful. We are told by scientific agriculturalists that with modern methods of intensive farming a small plot of ground can be made to yield a good living for a small family. The magazines and newspapers are filled with accounts of what can be raised on an acre of land. The older countries of Europe, where land is scarce, have shown us what can be done with a little land. This is especially true of Denmark, where the largest farms rarely exceed 50 acres, and many of them contain only from 10 to 20 acres.

Has the time not come for us to learn the lesson? Is it not practicable that this method of intensive farming can be adapted to the solving of the tuberculosis problem?

Chairman: The slogan, "No Uncared-for Tuberculosis" within a definite time, carries with it greater significance than merely providing sanatoria and the means of cure, tasks gigantic enough in themselves. It must also compass the thought that we must provide some means of employment for the wage-earner stricken at the most productive period of his career when he goes back to work. The whole question of employment is attracting the attention of physicians who are close to this work.

Dr. J. H. Elliott, Toronto: I am sorry not to have heard Dr. Forster's paper, but I know his work very well. While I do not know the trend of his paper, I hope that he has pointed out the fact that although his patients do well by working in the day-time, he offers them at night the advantage of sleeping in the open air. It has been my privilege to watch some 2000 discharged patients from sanatoria, and I have come to the same

conclusion as Dr. Lowman, that the work a discharged patient should go to after leaving the sanatorium is quite immaterial as long as it is commensurate with his strength.

Dr. Gordon Wilson, Baltimore: I think Dr. Lyman has demonstrated the fact that the employment matters very little. I think that Dr. Vogeler's idea is a very good one, namely, a club meeting once a month. You want to get close to your patients. It seems to me that if you will have a night dispensary and also, if possible, night camps for those patients who will take advantage of it, in that way you will look after their "fourteen hours" that Dr. Lyman has spoken of, and at the same time keep track of the patients.

Dr. J. C. Foltz, Philadelphia: I think this idea that patients when they are discharged should be kept track of is a very good one. Something of that sort is done in Pennsylvania by the State work at Mont Alto. Every case is referred back to the original dispensary whence it came, and they are supposed to keep track of it. This morning the suggestion was made that cases were not taken back at some sanatoria after six months' treatment, that they were then considered cured and should shift for themselves. Of course, they are not cured; they are only arrested, and if not controlled,—as they very often do not go back to their doctor, thinking they know all about it themselves,—they finally revert to the condition they were in before. So it is necessary to keep track of them. I think they should be returned to a dispensary, and a thorough watch kept upon them for several years after they leave the dispensary; and to do that, of course, the doctor to whom they are referred will look out for the sort of work they do. The question of day camps has been discussed in former meetings, and I think they have not proved very successful or satisfactory because they are a great expense; but I think if such camps are used also as night camps, providing some place for arrested cases to go, such a plant might be used over in the night as well as the day, and be made more practical, and from a monetary point of view, more useful.

Dr. Myer Solis-Cohen, Philadelphia: At the home for consumptives at Chestnut Hill the women patients are taken into the training school as soon as their condition warrants it, and they make better nurses than hospital graduates—that is, better tuberculosis nurses. They understand better the nursing of consumptives, and when they leave, they can easily get positions. There is always a demand for them. When they are graduated they go west, or to other sanatoria, and make from forty to fifty or sixty dollars a month, which is considerably more than many cured or arrested consumptive women can make.

Women patients in a tuberculosis dispensary can often be trained for social service work. They can be given a permanent position of this sort, and such patients make very enthusiastic workers. Having been through the experience themselves, they know how to teach the patient. They appreciate how the patient feels, and having done the same things themselves, they are listened to even by the so-called unteachable consumptive with respect, and their directions are followed much more faithfully than when coming from some non-tuberculous woman who has taken up social service work.

Dr. V. F. Cullen, State Sanatorium, Md.: There is just one point in connection with patients working on a farm that I would like to mention here, and that is the fear of the general public of the consumptive, a fact that must always be taken into account. If the general public knew that these tuberculous people were picking berries and raising lettuce and other vegetables, etc., and this produce was being sold, I fear that there would be great difficulty in obtaining a sale; at least that is the trend in our community. The patients at the Maryland State Sanatorium have made a number of baskets, rugs, etc., and these we have had to have fumigated before they were sold; and I feel certain that any green vegetables raised on the farm that could not be used in the sanatorium (unless they went to commission merchants, so that the source was not known) would find a market with great difficulty. I would like to say with Dr. Solis-Cohen that we have had the same experience with nurses. We have now about twelve in our establishment, and the results from them are just as satisfactory as they are with the average graduate nurse. They take just as good care of the patient, are interested in their work, and are satisfactory in every way.

Dr. Forster, Louisville: I am glad that Dr. Lyman and these other gentlemen agree with me so thoroughly. Before preparing my paper I wrote to Dr. Lyman because I already had an inkling as to his views, and I wanted to answer them in my paper before he had the opportunity of answering me. I did call attention in my paper to the fact that Dr. Lyman's results are most excellent; and, as far as that goes, it is essential that, as far as possible, the consumptive be returned to his community and to his old environment and work, where it can be done with safety. But with the class of patients that I have had to deal with, the number in which this plan would be safe is very limited, and their amount of intelligence and capability is of a very different order from such patients as those mentioned by Dr. Lyman. The only man of that class we had at our place is now superintendent of the farm, and although he had been a moulder for, I think, some fifteen or sixteen years previously,

he has lent himself to the work very energetically, and accomplished very good results. He started in with the cows, and I think now he knows a good deal more about cows than the average veterinarian. He has developed his farm work to the same extent. The majority of cases we have to deal with, that is, the indigent consumptives, receive a very low rate of remuneration, and undoubtedly, if they return to their former environment, if their condition is at all advanced, sooner or later they are going to return to some institution for treatment. Now, if we utilize the farm colony only for those cases that return,—if we follow the plan of returning all our cases to their old environment and utilizing the farm colony for only those cases that fail,—it would prove its value undoubtedly, because otherwise we will simply have to turn these patients into hospitals for advanced cases, and there maintain them at a larger cost than would be required on the farm. Dr. Lyman has had more experience in farm life than I have, but in truck farming close to a large city, if you develop along with that truck farming, chicken raising, rabbit raising, pigeon and squab raising, you can find employment which will suit the physical condition of almost any case. In our farm colony we had incipient, moderately advanced, and advanced cases, and we had not the slightest trouble in finding something for each class to do, if it was simply picking tomatoes, or assorting tomatoes, or feeding chickens. I am very glad that Dr. Hatfield spoke of the importance of individualization. Undoubtedly, each case presents a problem in itself, and we will have to so direct our organization that we will be able to find something for each individual case; and my only claim is that the farm colony takes this place in our organization to care for those cases which cannot be provided for in any other way; and I think as the work increases that class of cases is going to increase. If we take, for instance, the Pennsylvania State Sanitorium, which now I think has 700 beds, and which shortly I believe will have 1400 beds, if we simply turn back into the community each year 1400 cases that have moderately advanced or even incipient tuberculosis, you will then begin to realize how large the number of relapses there are that are bound to occur, and if we take them back into the institution, give them another course of treatment and then turn them out again for another relapse and then take them back again and give them another course of treatment, it is not hard to see how very large the cost is going to be of caring for these cases in that way. The chief problem pointed out by Dr. Lyman was the difficulty of keeping the patients long enough, and that to my mind is another very good argument for the farm colony; because if you can give the patient something to interest him, which may promise some remuneration, if you do not prevent his returning to the old position altogether, you can prolong his stay in the institution.

THE ENFORCEMENT OF ANTI-SPITTING LAWS

By Robert J. Newton

St. Louis

I have been asked to speak on the "Enforcement of Anti-spitting Laws." From a study of the subject I am convinced that a better title for this paper would be "The *Lack* of Enforcement of Anti-spitting Laws."

In America, when people for any reason disapprove of certain acts of others they say, "*There ought to be a law*," and after a sufficient number of people have said this a sufficient number of times, *there is a law* prohibiting the objectionable act.

The mere act of writing on the statute books the law representing the will of the majority seems to satisfy the people, who then serenely continue about their usual business or vocation, content in the knowledge that the law forbids or commands certain things which they contended for or against. Unless the matter be of grave importance, or unless it mean dollars and cents to people interested, the whole thing ends there. Occasionally it will come up again if *some* one for *some* reason stirs up the subject, and for a brief time the law may be enforced, and again it will lapse into the state Grover Cleveland so aptly described as "innocuous desuetude."

I am led to make these pessimistic remarks after a study of the returns from 74 cities and 7 States which have enacted laws forbidding expectoration in public places. I have a strong suspicion that the same general condition of apathy exists throughout the country in regard to that other antituberculosis ordinance, the "compulsory registration" law.

PURPOSE OF THE ORDINANCE

The purpose of the anti-spitting ordinance is twofold: *first*, to abate a nuisance; *second*, to prevent disease. While the nuisance is a very real one, and from that standpoint, if no other, spitting should be prohibited, the danger of the spread of disease by spitting in *public* places has been exaggerated. This exaggeration, however, is excusable if it will aid in abating the nuisance.

Spitting upon the sidewalks, in street-cars, and in public places is not nearly so dangerous as the spitting in tenement homes, cheap lodging-houses, factories, work-shops, and other places which the average anti-spitting law does not presume to prohibit. Most of the laws passed are weak in this respect.

But it is not for me to prove that spitting spreads disease or is a nuisance.

Enough people have agreed on one or the other point to secure the passage of laws forbidding the filthy habit in not less than 74 cities and 7 States. Roughly estimating, 25,000,000 Americans have been forbidden by law to expectorate in public places. Let us see how they obey this restriction.

Mr. Jacobs, the assistant secretary of the National Association for the Study and Prevention of Tuberculosis, sent a circular letter to all American cities of 30,000 population or over in an effort to secure facts for the preparation of this paper. Two-thirds of these cities responded. It is fair to assume that the people of the cities not responding are still permitted to spit, unhampered by any law.

PROGRESS OF THE CRUSADE

The first anti-spitting law in the United States was adopted in New York, May 12, 1896, at the suggestion of Drs. Biggs and Prudden. It was framed for the purpose of diminishing the spread of tuberculosis.

The anti-spitting crusade cannot be said to have spread like wildfire. Since New York city paved the way, other towns have followed slowly. Ordinances* have been passed as follows:

In 1896	3	In 1904	6
In 1897	1	In 1905	7
In 1898	0	In 1906	8
In 1899	6	In 1907	8
In 1900	5	In 1908	1
In 1901	6	In 1909	3
In 1902	2	In 1910	1
In 1903	4		

In five cities where no ordinance exists a health regulation forbids spitting. In one city a police regulation is enforced. Seven States have taken action against the spitter as follows: Massachusetts, Maine, New Hampshire, Rhode Island, Pennsylvania, Kansas, and Texas. Nineteen of the cities which have anti-spitting ordinances or health regulations are located in the above-named States, so the inhabitants are under a double prohibition.

RESPONSIBILITY FOR ENFORCEMENT

In 43 cities the duty of enforcing the law *rests* with the police. The word *rests* is here accurate in a double sense. In 16 cities the health officers are charged with the responsibility of securing obedience to the law. In 11 cities

* In responses from seven cities the date of the passage of the ordinance was not given. From the records it appears that the second ordinance was passed by West Newton, Mass., and the third by Sacramento, Cal.

the duty is placed on *both* police and health officers. Nine cities were honest enough to say that *no one* enforced the law. In Manila arrests were made by the police, but no separate record was kept and no report of the actual number could be made. This was true of several other cities. In Canton, Ohio, it was reported that the mayor was clothed with power to enforce the law, and he did his duty nobly, having been given credit for one arrest during 1909. I regret to report that he failed to secure a conviction. No wonder he made but one arrest.

NUMBER OF ARRESTS

In the 7 States and 74 cities the police, health officers, and both combined, with the assistance of the Honorable Mayor of Canton, made a total of 3421 arrests for violation of State laws, city ordinances, and health regulations—3421 persons, *undoubtedly all males*, out of a population of 25,000,000.

This might seem to disprove my former assertion of a failure to enforce the laws. Again consulting the records, we find that 2513 of these arrests were made in New York city alone, thus proving activity there, and a lack of it elsewhere. In 12 other cities 20 or more arrests were made, totaling 788, as follows:

Baltimore	214	Washington	42
Pittsburg	193	Milwaukee	35
St. Louis	56	Atlanta	30
Chicago	50	Spokane	28
Kansas City	50	Cincinnati	20
Newark, N. J.	50	Indianapolis	20
		Total	788

Twenty-three other cities reported a total of 120 arrests:

Johnston, Pa.	16	Buffalo, N. Y.	2
Wheeling, W. Va.	14	Elizabeth, N. J.	1
Boston, Mass.	12	Oshkosh, Wis.	1
Butte, Mont.	12	Jersey City, N. J.	1
New Haven, Conn.	12	Fall River, Mass.	1
Seattle, Wash.	10	Canton, O.	1
Ogden, Utah	7	Youngstown, O.	1
Lincoln, Neb.	6	Yonkers, N. Y.	1
Manchester, N. H.	5	Duluth, Minn.	1
New Orleans, La.	4	Lynn, Mass.	1
Augusta, Ga.	4	Total	120
Springfield, Mass.	4		
Brockton, Mass.	3		

Out of the 74 cities reported as having an anti-spitting ordinance, only 36, or *less* than one-half, made any arrests under the ordinance.

EFFICIENCY OF POLICE AND HEALTH OFFICERS COMPARED

As to the relative efficiency of the police and health officials in enforcing the law, the following figures will be interesting:

Arrests by Police.		*Arrests by Health Officers.*		*Arrests by Both.*	
Chicago	50	New York	2513	Pittsburg	193
Washington	42	Baltimore	214	New York	50
Atlanta	30	St. Louis	56	Spokane	28
Cincinnati	20	Kansas City	50	All other towns	23
All other towns	76	Milwaukee	35		296
	218	Indianapolis	20		
		All other towns	21		
			2909		
		New York excluded	396		

Even if we exclude New York city the health officers have a better record of arrests than the police. The lax enforcement of the law in most cities is due to the fact that the police will not enforce the ordinance, regarding it merely as intended to abate a minor nuisance, while, on the other hand, the health officer enforces the law more effectively because in so doing he is working for the prevention of the spread of disease.

CONVICTIONS

An arrest for spitting does not mean a conviction and fine in all cities. Of the 3421 persons arrested, 2912 were convicted, 1 of every 7 escaping. The total amount paid in fines was $4100.87, an average of $1.35. In New York, of the 2513 arrested, there were 2099 convicted, 1 in 5 escaping. The total fines were $1936.80, an average of less than $1.00. In Pittsburg 193 were arrested and 170 convicted, 1 out of 7 escaping. In St. Louis, located in a State where the evidence must always be conclusive, 50 were arrested and 35 convicted, 1 in every 3 escaping conviction. Baltimore, Butte, Mont., Spokane, Wash., Atlanta, Ga., Washington, D. C., Kansas City, Mo., Milwaukee, Wis., and Newark, N. J., convicted every one arrested, as did a number of the smaller towns where only a few arrests were made.

AMOUNT OF FINES

If you have to spit, don't spit in Buffalo, N. Y., for it may cost you $25. Two men paid that amount each in fines last year. The cheapest place to spit in is Indianapolis, where people paid an average of 78 cents. Next comes New York, with an average of 91 cents. Baltimore, Pittsburg, Kansas City, and Spokane, $1.00 each.

The following table gives this information in detail.

CITIES WHERE 20 OR MORE ARRESTS WERE MADE.

	Number of Arrests.	*Number Convicted.*	*Total of Fines.*	*Average.*
Cincinnati	20	0	0	0
Indianapolis	20	14	11.00	0.78
New York	2513	2099	1,936.80	0.91
Pittsburg	170	170	170.00	1.00
Baltimore	214	214	214.00	1.00
Kansas City	50	50	50.00	1.00
Spokane	28	28	28.00	1.00
Chicago	50	45	50.00	1.11
Washington	42	42	99.00	2.35
Atlanta	30	30	100.00	3.35
Milwaukee	25	35	131.00	3.75
St. Louis	56	35	261.00	7.50
Newark	50	49	490.00	10.00

The fines in other cities vary just as they do in the above cities, Buffalo, N. Y., assessing the highest fine, $25.00. This is unreasonable and unjust; a fine of $1.00 to $5.00 is fair.

CITIES WHERE LESS THAN 20 ARRESTS WERE MADE.

	Number of Arrests.	*Number Convicted.*	*Total of Fines.*	*Average.*
New Orleans	4	0	0	0
Manchester, N. H.	5	1	0	0
Yonkers, N. Y.	1	1	0	0
Canton, O.	1	0	0	0
Augusta, Ga.	4	4	4.00	1.00
Fall River, Mass.	1	1	1.00	1.00
Lincoln, Neb.	6	4	8.00	2.00
Springfield, Mass.	4	4	12.00	3.00
Brockton, Mass.	3	3	10.00	3.33
Oshkosh, Wis.	1	1	4.03	4.03
Johnston, Pa.	16	16	71.35	4.45
Wheeling, W. Va.	14	13	61.50	4.73
Lynn, Mass.	1	1	5.00	5.00
Youngstown, O.	1	1	5.00	5.00
Seattle, Wash.	10	7	35.00	5.00
Butte, Mont.	12	12	60.00	5.00
Boston, Mass.	12	10	50.00	5.00
Ogden, Utah	7	7	50.00	7.14
New Haven, Conn.	12	12	100.00	8.33
Elizabeth, N. J.	1	1	10.00	10.00
Jersey City, N. J.	1	1	10.00	10.00
Duluth, Minn.	1	1	13.19	13.19
Buffalo, N. Y.	2	2	50.00	25.00

REASONS FOR NON-ENFORCEMENT

The *real* reason for non-enforcement of the law is, of course, indifference on the part of the citizens of a community, a lack of civic pride, and a failure to appreciate the danger from the unrestrained practice of this vile habit.

Indifference on the part of the health officials is primarily responsible, for upon them the community depends for leadership in all such matters. Where the health official tries to do his duty and enforce the law, he is frequently hampered by the indifference of the police. Where the health officer persists, he can in time secure action by the police department.

In some places complaint is made of the difficulty of securing prosecuting witnesses. In Cincinnati some women agreed to appear as witnesses, but failed to do so, and the prosecution failed. This has occurred in other places. It is hardly proper to expect women to aid in this manner.

A novel excuse is advanced by Jacksonville, Fla., for non-enforcement: "This being a tourist city, it was deemed inadvisable to enforce the law." In Wheeling, W. Va., they arrest the natives, but are hospitable enough to dismiss with a warning a stranger who unwittingly offends against this law. In Lincoln, Neb., it is reported that "strangers spit, but town people do not."

Given a live health officer, no community has any reason or excuse for the non-enforcement of this or any other sanitary law. Why the people should always have to insist on, and work to secure, enforcement of the laws by those who are employed and paid to do so, is hard to comprehend.

SUGGESTIONS FOR ENFORCEMENT

To secure the enforcement of an anti-spitting ordinance the old advice about the hare applies: first get your ordinance and get a good one, then have it passed by your city fathers. If your city has already passed an ordinance and it is not a good law, have it amended quietly, without publicity.

The next step is *publicity*, and more publicity, and the right kind of publicity. The people must learn the reason for the prohibition of spitting; that spitting is a nuisance and a means of spreading consumption and other diseases.

The first step in the educational campaign should be the posting of a copy of the ordinance, and brief sentences calling attention to its purpose and the reasons for its passage, in all places where spitting is prohibited. The ordinance should require all persons in charge of such places to post such notices and copies of the law.

Next, attention should be directed to the law in the columns of the newspapers, by posters on billboards, by cards in pay envelopes, notices on the backs of street-car transfers, tin signs, advertisements in theater programs, slides in moving picture theaters, in all antituberculosis literature, and by lectures, and in every one of the many ways in which facts about tuberculosis and its prevention are being disseminated.

That the educational campaign brings results has been proven in many cities. Replies received to the request for suggestions of methods to secure enforcement of the law all emphasize the importance of education along these lines.

Then it should be announced that on a certain day the police and health officers will begin arrests for violation of the law, and this warning must be enforced. As many arrests as possible should be made, and publicity to the arrests should be secured. A week of work of this kind will clean up a city for several months.

After such a "raid," if the city or town can afford it, one or more policemen or health officers in "plain clothes" should be detailed to the work. For a period of a month or even longer the officer should only admonish offenders by means of a printed card and a verbal warning. This will be effective in bringing about a more willing compliance with the ordinance than if arrests and punitive measures were forthwith and constantly carried on. Where a community cannot afford to employ a man for this work, some of the citizens, especially the ladies, could carry cards with them as they go to and fro about the city and hand them to the careless spitter.

"Raids" will be necessary at more or less regular intervals, for the purpose of attracting attention to the ordinance and the fact that it is being enforced. As a rule, people are not wilfully negligent, but they quickly forget, and must be forcibly reminded. A card reminding the "spitter" of the nastiness of his offense and that he is liable to arrest and fine will be sufficient in most cases. The public generally are quickly won to favor the anti-spitting law, and regard the offender with severe contempt.

It has been proven that the regular police cannot be depended on to enforce the law, and that special police or health officers with the power to arrest must be detailed to the work to secure results.

It is not necessary to let the public know how many or rather how *few* men are really actively engaged in enforcing the law. Let the public believe that there is a real and constant danger of arrest by any of the regularly constituted guardians of the law. If you can only get a man to *think* before he spits, he will walk to the curb and spit in the gutter. Spitting in the street is preferable to spitting on the sidewalk, because the shoes and skirts will not be contaminated, and the sunlight will probably destroy any germs in sputa before they can be taken up in dust and inhaled.

ST. LOUIS

Our experience in St. Louis might be of interest. The anti-spitting ordinance was passed in February, 1903, and the chief of police issued an order for its enforcement. There were a few arrests at that time, and then the law was forgotten.

In 1907 the women members of the Anti-Tuberculosis Society took up the matter and interested the police commissioners and the board of health. Two health department inspectors were sworn in as private watchmen, with the sole duty of making arrests for the violation of this ordinance. During the year 1908, 336 arrests were made, and $1271 in fines assessed and collected. The salaries paid the inspectors amounted to $1735. The fines paid 73 per cent. of the salaries of the two special officers for the year, and in some months more than paid their salaries.

During 1909 these men were assigned to other duties, and the total number of arrests was only 56, with a corresponding increase of the nuisance. Appeals to the chief of police resulted in the issuance of another order to all patrolmen to enforce the law. None of them obeyed the order.

In February of this year the grand jury was asked to call on the chief for an explanation of the police department's neglect of this matter, and according to the newspapers the chief spent an uncomfortable half-hour trying to explain matters. The net result of the interview was that the two health department inspectors are again at work, assisted by two regular uniformed policemen. Three hundred and fifty-two arrests have been made by these four men in the last four months, and $2357 assessed in fines.

The street-car company has placed seven tin signs in each car, copies of the ordinance have been posted in all public places, and constant publicity is given to the subject. We believe we shall have, during 1910, a cleaner St. Louis.

SUGGESTIONS FROM HEALTH OFFICERS

Following are a few of the suggestions submitted by health officers:

A sign placed in street-cars requesting spitters to stand on the rear platform will bring good results.

It was proposed by one city that the offender should be compelled to clean up the result of his offense or take his choice of arrest and fine. Such an experience would "cure" a spitter for a lifetime.

Another city suggested the education of the children.

A health officer writes: "Man is the only spitting animal, that is, except

the cat, which only spits when he is mad. Man spits because he is catarrhal. He is catarrhal because, as a child, he had large tonsils, adenoids, and other upper respiratory obstructions. I do not believe that the enforcement of a spitting ordinance, however much I would like to see it enforced because it is a law, would materially help in abating the spitting nuisance. Medical school inspection, free clinics for children, the school nurse, outdoor schools, and the prevention of child labor are all means for the prevention of the spitting habit. You cannot cure the spitting habit by arresting spitters."

Another health officer writes: "A novel scheme was proposed a year ago, but was not carried out, which was to employ a half-dozen or more uniformed boys, who would walk the principal streets and when they found a person spitting on the sidewalk would immediately use a can and brush, covering the spittle with a disinfectant that would quickly dry. This act would, of course, attract attention on a crowded thoroughfare, and the first question asked by an officer or citizen would be as to what the boy was doing; and in reply the boy would hand him a card on which would appear appropriate phrases answering the question and speaking of the necessity for such disinfection. I was of the opinion this would attract a great deal of attention, mortify the spitter, and probably do more good than the signs above mentioned."

The following report comes from Manila:

"Our own work in this direction has been along the lines generally adopted; for instance, a sanitary cuspidor, used by the bureau and considered to be the most practicable design, has been recommended for general service throughout Government offices; a circular was also issued recommending that the floors of all Government buildings be sprinkled with wet sawdust before being swept, and also that this operation be postponed until all employees had left the building. These, together with a great many other measures of a similar character, have been found to be effective when properly enforced."

NATIONAL ASSOCIATION'S INVESTIGATION STIMULATES INTEREST

Good results always follow agitation of this subject. This is shown by the fact that the letter of the National Association requesting facts on the enforcement of the law has stirred up interest in the subject all over the country. In many places an assurance is given by the health officers that the law will be enforced, or *more strictly* enforced, in future. In several places the letter of inquiry led to a discovery of the fact that an anti-spitting ordinance had been passed and forgotten.

Following are some newspaper headlines showing the results of the inquiry:

CHICAGO RECORD HERALD, April 1, 1910.

Anti-Spit Crusade On.

Movement launched by representatives of fifteen organizations. Plans for campaign made. Cards in various languages warning violators of ordinance are prepared.

LOUISVILLE, KY., TIMES, January 19, 1910.

Ordinance to be rigidly enforced. Spitting in public must stop, says Safety Board, and so instructs police.

WILKESBARRE, PA., RECORD, April 11, 1910.

Anti-Spitting Crusade.

Civic Club appeals to Sheriff to enforce State laws. Want especial officer appointed to arrest persons expectorating in cars or in public places.

SAN FRANCISCO, CAL., POST, March 28, 1910.

Stop expectorating in public vehicles. *Anti-Tuberculosis* Society to put end to the evil practice.

OAKLAND, CAL., TRIBUNE, March 23, 1910.

To prevent the spread of disease.

SYRACUSE STANDARD, April 1, 1910.

Anti-Spitting Crusade is on.

Beebe Company asks coöperation of 40 towns and villages.

Cuspidors in all trolleys. Board of Health urged to make spitting on car floors or platforms punishable by a fine of $5.00.

NEW ORLEANS ITEM, April 10, 1910.

To stop spitting (editorial).

I believe that during the present year we shall see a more rigid enforcement of the ordinance than before, due to the activity and interest of our National Association.

A MODEL ORDINANCE

The anti-spitting ordinance, to be effective, must be brief and definite. A study of some ordinances shows defects which explain why they are not enforced. They are not definite and specific in their prohibition, or they exempt certain places, especially houses, dwellings, tenements, offices, factories, workshops, and other places. Then, again, some of them place the penalty too high, and a few convictions with a large fine bring public condemnation of the law.

I submit herewith a "model" ordinance for the prohibition of expectoration.

AN ORDINANCE TO PROHIBIT THE DEPOSIT OF SPUTUM IN CERTAIN PLACES

WHEREAS, the deposit of sputum is a nuisance and prejudicial to the public health, therefore,

Be it ordained by the————————of the————————as follows:

Expectoration Prohibited

Section 1.—Spitting upon the floor, walls, sides, steps, stairways, or platform of any railroad, steam, electric, elevated, street, subway, station, or car,

or elevator car, or any public or private conveyance, or of any public or private building, hall, theater, church, school, hotel, lodging-house, factory, work-shop, or other place of employment, or any house, tenement house, market, or upon any sidewalk in any public or private place, or premises, is hereby prohibited and declared a nuisance and a misdemeanor.

Posting of Ordinance Required

Section II.—It shall be the duty of all corporations or persons having charge of any place mentioned in the preceding section to have as many copies of this ordinance as may be required by the health commissioner framed and permanently posted in conspicuous places. Printed copies of the ordinance, together with brief sentences explaining the purpose of the ordinance, shall be furnished all such persons by the health commissioner. The health commissioner shall post, or cause to be posted, similar notices upon the public streets.

Spittoons Required in Buildings

Section III.—It shall be the duty of every corporation or persons in charge of any building mentioned in Section I of this ordinance to furnish as many receptacles for the reception of sputum as may be required by the health commissioner, of a pattern, shape, or design approved by the health commissioner, and such receptacle shall contain water and a disinfectant prescribed by the health commissioner, and shall be cleaned and disinfected daily, and shall always be placed upon a rubber mat or paper or other stand prescribed by the health commissioner.

Responsibility of Enforcement

Section IV.—It shall be the duty of the police officers of the city to arrest any person violating any of the provisions of this ordinance. It shall be the duty of all persons in charge of any of the places mentioned in Section I of this ordinance to watch for and cause the arrest of any person violating any of the provisions of this ordinance. It shall be the duty of the health commissioner to enforce this ordinance.

Section V.—Any person violating any of the provisions of this ordinance, or any person who shall fail to report such violation, upon conviction shall be deemed guilty of a misdemeanor and punished by a fine of not less than one dollar nor more than five dollars, and one-half of such fine shall be paid to any person who shall furnish information which shall lead to the conviction of the offender.

AMERICAN CITIES OF 30,000 POPULATION AND OVER AND THEIR POSITION IN THE ANTI-SPITTING CAMPAIGN.*

	Name of City.	*Population.*
A.	New York, N. Y.	4,225,681
A.	Chicago, Ill.	2,107,620
B.	Philadelphia, Pa.	1,466,408
A.	St. Louis, Mo.	661,666
A.	Boston, Mass.	609,175
A.	Baltimore, Md.	561,120
A.	Pittsburg, Pa.	531,527
C.	Cleveland, O.	475,864
A.	Buffalo, N. Y.	386,724
B.	San Francisco, Cal.	342,782
C.	Detroit, Mich.	367,494
A.	Cincinnati, O.	347,123
A.	Milwaukee, Wis.	322,513
A.	New Orleans, La.	318,652
A.	Washington, D. C.	312,548
A.	Newark, N. J.	295,979
C.	Minneapolis, Minn.	285,676
A.	Jersey City, N. J.	243,205
B.	Louisville, Ky.	229,599
A.	Indianapolis, Ind.	227,698
C.	St. Paul, Minn.	210,606
B.	Providence, R. I.	207,850
B.	Rochester, N. Y.	189,384
A.	Kansas City, Mo.	185,479
B.	Toledo, O.	164,673
C.	Denver, Colo.	153,524
C.	Columbus, O.	148,722
C.	Los Angeles, Cal.	
B.	Worcester, Mass.	132,020
A.	Seattle, Wash.	
C.	Memphis, Tenn.	128,799
B.	Omaha, Neb.	127,768
A.	New Haven, Conn.	123,427
B.	Scranton, Pa.	121,343
B.	Syracuse, N. Y.	120,631
C.	St. Joseph, Mo.	120,504
B.	Paterson, N. J.	114,072
C.	Portland, Ore.	112,757
A.	Atlanta, Ga.	107,265
B.	Richmond, Va.	106,227
A.	Fall River, Mass.	106,121
C.	Nashville, Tenn.	105,278
C.	Dayton, O.	103,248
C.	Grand Rapids, Mich.	101,832
B.	Cambridge, Mass.	99,653
B.	Albany, N. Y.	99,268
B.	Hartford, Conn.	98,484
B.	Lowell, Mass.	95,157
B.	Reading, Pa.	93,171
C.	Trenton, N. J.	88,529
C.	Bridgeport, Conn.	86,487
C.	Wilmington, Del.	86,420
C.	Camden, N. J.	86,343
C.	Des Moines, Ia.	81,020
B.	Kansas City, Kan.	80,522
A.	Lynn, Mass.	80,453
B.	New Bedford, Mass.	79,130
A.	Springfield, Mass.	78,132
B.	Troy, N. Y.	76,756
C.	Oakland, Cal.	
B.	Lawrence, Mass.	73,056
B.	Somerville, Mass.	72,323
C.	Savannah, Ga.	69,880
A.	Duluth, Minn.	69,731
B.	Norfolk, Va.	68,530
B.	Hoboken, N. J.	67,709
C.	Peoria, Ill.	67,704
A.	Yonkers, N. Y.	66,806
C.	Utica, N. Y.	66,552
A.	Manchester, N. H.	65,989
B.	Schenectady, N. Y.	65,625
C.	Evansville, Ind.	65,282
B.	San Antonio, Tex.	64,275
A.	Elizabeth, N. J.	63,860
B.	Waterbury, Conn.	63,696
B.	Salt Lake City, Utah.	62,216
B.	Wilkes-Barre, Pa.	61,521
B.	Erie, Pa.	61,202
B.	Houston, Tex.	59,963
C.	Tacoma, Wash.	
B.	Harrisburg, Pa.	56,663
C.	Charleston, S. C.	56,402
B.	Portland, Me.	56,003
A.	Youngstown, O.	54,402
B.	Dallas, Tex.	54,338
C.	Terre Haute, Ind.	53,707
B.	Fort Wayne, Ind.	52,219
C.	Akron, O.	52,073
B.	Holyoke, Mass.	51,622
A.	Brockton, Mass.	50,886
C.	Covington, Ky.	50,495
C.	Saginaw, Mich.	49,808
A.	Lincoln, Neb.	49,590
B.	Altoona, Pa.	48,878
A.	Spokane, Wash.	
B.	Lancaster, Pa.	48,078
C.	Birmingham, Ala.	47,097
C.	Bayonne, N. J.	46,078

* The letters preceding the names of the towns have the following significance, compiled from reports of health officers:

A. Have a state law, ordinance or health regulation and enforce it by arrests.

B. Have an ordinance or health regulation, but do not make any arrests to enforce it.

C. Have no ordinance or health regulation.

C. South Bend, Ind.	46,005	B. Newcastle, Pa.	38,564
A. Butte, Mont.	45,492	B. Salem, Mass.	38,295
B. Pawtucket, R. I.	45,041	B. Newton, Mass.	38,123
B. McKeesport, Pa.	44,851	B. Haverhill, Mass.	38,092
B. Binghamton, N. Y.	44,475	B. Jacksonville, Fla.	38,049
B. Johnstown, Pa.	44,340	C. Joplin, Mo.	37,297
C. Dubuque, Ia.	44,198	B. Wichita, Kan.	36,898
B. Sioux City, Ia.	44,088	C. Rockford, Ill.	36,701
A. Augusta, Ga.	43,739	C. Knoxville, Tenn.	36,620
C. Mobile, Ala.	43,642	C. Elmira, N. Y.	35,744
B. Topeka, Kans.	42,792	B. Galveston, Tex.	35,224
B. Springfield, O.	42,704	C. New Britain, Conn.	34,641
B. Allentown, Pa.	42,618	B. Chattanooga, Tenn.	34,416
C. East St. Louis, Ill.	42,530	B. Kalamazoo, Mich.	33,816
A. Wheeling, W. Va.	41,929	B. Woonsocket, R. I.	33,792
C. Montgomery, Ala.	41,847	B. Fitchburg, Mass.	33,617
B. Passaic, N. J.	41,761	B. Racine, Wis.	33,565
C. Davenport, Ia.	41,614	C. Auburn, N. Y.	33,399
C. Atlantic City, N. J.	41,495	C. Macon, Ga.	32,765
C. Little Rock, Ark.	41,302	C. Joliet, Ill.	32,657
C. Bay City, Mich.	40,561	C. Oklahoma City, Okla.	32,452
B. York, Pa.	40,079	A. Oshkosh, Wis.	31,491
B. Malden, Mass.	39,786	C. West Hoboken, N. J.	31,477
C. Springfield, Ill.	39,631	B. Sacramento, Cal.	31,311
C. Quincy, Ill.	39,583	C. Pueblo, Colo.	31,190
A. Canton, O.	38,972	B. Everett, Mass.	31,021
C. Superior, Wis.	38,735	B. Taunton, Mass.	30,940
B. Chester, Pa.	38,670	C. Newport, Ky.	30,667
B. Chelsea, Mass.	38,575	C. La Crosse, Wis.	29,151
C. South Omaha, Neb.	38,558		

THE SCHOOL CHILD AND TUBERCULOSIS: A PLEA FOR PREVENTORIA

By Henry Farnum Stoll, M.D.

Hartford, Conn.

Largely due to an ever-increasing knowledge of the etiology of disease, prevention in medicine is receiving more and more attention each year. And were we to apply faithfully all the preventive measures we are familiar with, what an immense amount of unhappiness, suffering, and financial loss would be spared mankind! Typhoid fever, for example, would cease to carry off its thousands each year did we but see to it that our water-supply was pure and sewage properly disposed of.

However interesting the consideration of prophylaxis in the different diseases might be, we must content ourselves with the one disease, viz., tuberculosis. The discovery of the tubercle bacillus by Professor Koch, in 1882, was the beginning of a new era in that disease. Hitherto considered a hereditary malady, he demonstrated that it was due to a tiny plant called a germ, present in the material expectorated by the consumptive, and that without that particular germ there was no consumption.

In this paper we will consider the havoc wrought among children by this tiny bacillus, and try to find some way of preventing its ravages. The question naturally arises in our mind, Is tuberculosis common among children? This has been the subject of extensive investigation in both this country and Europe, and it has been found that a large number have the disease.

Prussian statistics show that of every 100 boys who died at the age of five years, over 6 die from tuberculosis: and of 100 little girls at the same age, over 7 die from that disease. Then there is a big jump in the death-rate up to the tenth year: 9 in 100 for the boys, and 12 for the girls. Between ten and fifteen years it doubles for the boys, reaching 18, and more than doubles for the girls, as 29 die.

Think what that means! During the school age—from five to fifteen years —the death-rate from tuberculosis increases from 6.44 to 18.65 for boys, and

from 7.41 to 29.74 for girls. Surely it is high time we began to try to lower this frightful mortality. The death-rate record falls short of indicating the total number infected, as some "weather the storm" and recover more or less completely.

One should not conclude, from the great increase in the mortality which occurs during the school years, that the infection takes place, as a rule, in the school. Though tuberculosis is doubtless sometimes contracted from a careless tuberculous teacher or fellow-scholar, such cases are rare. The infection in the vast majority of cases takes place in the home, and the hard study, in badly ventilated school-rooms, by lowering the child's resistance, allows the germs to become active.

Why is the mortality higher among the girls? Because they spend more and more time in the home as they grow older, while their brothers are playing out of doors, and as tuberculosis is a "home disease," they are more exposed to infection. This is also shown by some recent work done in New York city. Several hundred children were given the tuberculin test, and the percentage of girls infected was 31.1 per cent. while for the boys it was 21.7 per cent.

Roux and Josserand found that 40 per cent. of the children in Paris showed signs of tuberculosis, and Comby detected evidences of tuberculosis in 65 per cent. of the children who died at the age of ten years.

In Vienna, where they still use double windows and heavy curtains during the winter to keep out the cold, Pirquet ascertained that 70 per cent. of the children had been infected by the tenth year. This does not mean, of course, that 70 per cent. had clinical tuberculosis.

Philip has recently called attention to the fact that, while there has been a marked diminution in the death-rate from tuberculosis in Edinburgh since 1891, in children up to nine years of age there has been a striking increase of the mortality between the ages of ten and fourteen.

In this country Lowman states that 20 per cent. of the children in the Cleveland schools are tuberculous or strongly suspicious.

In Boston, Drs. Floydam and Bowditch detected definite pulmonary disease in 36 per cent. of 1000 children examined at the Out-patient Department of the Boston Consumptive Hospital, and in about 30 per cent. more a tuberculous lesion existed elsewhere in the body. The majority of these children were from tuberculous families.

The question of exposure to tuberculosis in the home was very carefully investigated in 149 cases from the poor and middle classes recently examined by the writer. A definite history of exposure was obtained in 52 instances. Of these, 79 per cent. were found, by the use of the tuberculin test, to be infected.

Ninety-seven gave no history of exposure to tuberculosis, and of these, 26 per cent. were found to be infected. Forty-four children who were frail and delicate, but in whom there was no history of exposure, were tested, and 50 per cent. reacted. On the other hand, but 13 per cent. of 39 robust children not exposed were found to be infected. A much lower percentage would, in all probability, obtain in the well-to-do. Schlossman found only 5 per cent. positive reactions among his better class of patients. We see that the frail child is nearly four times as apt to be infected as the robust one.

While we will consider the child with definite tuberculosis, it is the child who has not yet developed the disease, but is, as the expression goes, "scrofulous," that concerns us especially.

Tuberculous disease of the bones or glands is more common in children than that of the lungs. In fact, the germs of tuberculosis rarely attack the lungs of children primarily. They lodge first in the lymphatic glands that surround the roots of the lungs, and in many cases are destroyed there. When, however, they are very numerous, or when the child "runs down" through insufficient food or lack of air, or develops one of the infectious diseases, particularly measles or whooping-cough, the disease may light up and the lungs be involved. Some of the best authorities assert that most of the cases of tuberculosis in the adult are in reality due to the germs acquired in childhood. These children usually have a poor appetite, look frail, tire easily, and often have a short, sharp cough. Until a couple of years ago we had no simple way of telling whether such children were tuberculous or not. Professor Pirquet, of Vienna, devised a test which is perfectly safe and easily performed. A drop of the substance known as tuberculin is put on the arm, and a small abrasion of the skin is made in the center of the drop. If the person has ever been infected, the point of inoculation looks considerably like a mosquito bite at the end of twenty-four to thirty-six hours. This test is, unfortunately, so delicate that many in apparently the best of health will react. Occurring in a robust child with no symptoms it should cause no undue alarm, for while it shows that the individual has been infected, it also shows that he has had sufficient resistance thus far to prevent the disease from developing. But a reaction in a delicate child is a sign of grave import, and means "watch out." Cases of open tuberculosis, *i. e.*, what is generally recognized as "consumption," are rare in the public schools—less than 1 per cent. probably. The child is taken out of school, as a rule, when the disease becomes advanced.

The late Professor Grancher, of Paris, himself childless, seems to have been the first to realize the importance of protecting the child. It is stated that the idea was suggested to him by Pasteur's work with the silkworms. This master

demonstrated that if one is to obtain healthy adult worms, he must start with the cocoon. He examined many thousand children in the schools of Paris, and found that a large percentage were either tuberculous or strongly suspicious. Some had tuberculosis of the bones—hip and spinal disease; others of the glands, so-called "scrofulous," and still others were found to have the disease in their lungs. He conceived the idea of getting these delicate children away from the city, and this has been done now for a number of years, with most gratifying results. In France over 60,000 have been treated in these seaside sanatoria since 1887, with 50 per cent. of cures and 25 per cent. of cases decidedly improved, making in all 84 per cent. of favorable results. Investigations made by several independent observers show that in about three-quarters of the cases the cures were permanent. Day camps for the scrofulous children have been established in a number of places in Germany.

In the neighborhood of Charlottenburg (Berlin) a school has been erected where the pale and weak children are kept for months at a time.

Sweden has been very active in the tuberculous work, and in 1906 over $13,000 was used in providing homes for the healthy children of tuberculous parents. At Gothenburg there is a home called "The Birthday," as it is supported by the gifts which charitable people contribute on their birthdays, or on the birthdays of those near and dear to them.

In this country the work was first taken up in Providence, R. I., and later at Boston, Mass. Outdoor schools were established in both cities, and the results were excellent.

At the annual meeting, a year ago, of the Hartford Society for the Prevention of Tuberculosis, a special committee was appointed for the improvement of the health of the children of tuberculous parents. Several plans were considered, the most ideal being to obtain a farmhouse in the country, or on the coast, where the children could spend the summer months, living outdoors day and night. This, however, was not possible at the time, so an outdoor school, or day camp, was decided upon. Permission was obtained from the Park Board to use a portion of Goodwin Park, which is one of our larger parks, situated about three miles from the center of the city. It would have been difficult to have conceived of a more ideal spot than the one generously given us by the Park Commission. Situated on a slope of ground, an extended view of the valley of the Connecticut and of the hills beyond was obtained toward the east, while dense woods protected it from the west wind. A number of large elm trees afforded a very welcome shade during the heat of the afternoon. An excellent spring of water was near the camp, and on the other side of the park there was a pond in which the children were allowed to bathe sev-

eral times during the week. Each child had a plot of ground assigned to it, on which several varieties of flowers were cultivated.

The camp consisted of two tents, each 20 feet by 30 feet, one of which was used as a kitchen and dining-room, and the other containing reclining chairs, book-cases, etc. The children were recruited from several sources. A number had parents who were under treatment for tuberculosis either in the Hartford Hospital or the Wildwood Sanitarium. Other cases came from the dispensary. Still others were gotten by means of a letter sent to the principals of the different school districts, asking them to coöperate with the school physician in picking out the delicate children. As a result of these various measures, over 50 children were obtained who were decidedly below par. As our facilities only allowed us to care for 25 children, the tuberculin test was given to all, and the more delicate of those that reacted were sent to the camp. None of them suffered from "open" pulmonary tuberculosis (that is, with germs in their sputum), and with the exception of one child with spinal disease, they were all cases of so-called "latent" or "larval" tuberculosis.

We were fortunate in obtaining the services of a very competent kindergarten teacher and an excellent cook.

It was extremely interesting to watch the improvement in the children. At first many were so delicate that they were content to sit around most of the time, but as the days went by, they soon began romping about and playing like "real" children.

Each child paid five cents a day. They were taken out to the park by special trolley car, arriving there at 8.30 in the morning and remaining until 5.15 in the afternoon. On arriving at the camp they were given a light breakfast. Following this all hands resorted to the tooth-brush. Most of the children, by the way, had never used a tooth-brush before.

They took turns in cleaning up after meals. Much the same program was followed out that was found so satisfactory in the Boston school. A certain time each morning was devoted to basket-weaving, talks on hygiene, or nature study. The time before the noonday meal was given over to a play spell. The dinner was usually quite a hearty one.

The food furnished at the camp was intended to supplement that received in their homes, but, except in two or three instances, the children were given nothing at home save possibly a cup of coffee or cocoa.

The time immediately after dinner was devoted to the rest hour, when the children were all required to lie quietly in their reclining chairs. And here a strange sight was witnessed. No one was allowed to talk during this period, and in a very short time one saw active, nervous children, who were never

quiet a moment all day, sound asleep. All of them would sleep more than half an hour, and it was not uncommon to have some of the children sleep an hour and a half or more every afternoon. A light supper was served at 4.30, and this was followed by a general tooth-brushing, after which they returned to their homes. Twice each week the children had light gymnastic exercises.

The total expense of equipping and operating the school for the summer was not quite $1225. Nearly $1000 of this amount was met by the money realized from the Red Cross Society by the sale of the stamps during the Christmas holidays. The average per capita cost per day, exclusive of milk, was seventeen cents. The milk bill was nine cents a day per child. The children were supplied with milk from tuberculin tested cattle almost exclusively.

Since January 1st, the city and the Society for the Prevention of Tuberculosis have joined hands in operating an outdoor school. A large tent was fitted up as a school-room, and two teachers were provided by the city. The Society furnished the meals and cook, besides the necessary wraps, blankets, sitting-out bags, etc.

It costs about $14 to fit out a child with sitting-out bag, two blankets, one comfortable, coat, sweater, mittens, toque, and reclining chair. The daily per capita cost of food is about 25 cents.

Two rooms in a large house adjacent were given over to the school, one being used as kitchen and dining-room, and the other as the rest room, where the after-dinner nap was taken. Some children who each winter in the past had a cough much of the time have been free from cough this year and the children who were coughing on admittance soon lost their cough. So much did they enjoy the school that there was great lamentation whenever a child, who had made marked improvement, had to make way for some one more delicate and feeble.

The teachers remarked that the mental fatigue common at the end of a session in the closed room was not present in the outdoor school.

In all, 40 children have received the benefit of the fresh-air instructions, the daily average being about 28. We have been greatly assisted in the work by the hearty coöperation of the Visiting Nurses' Association, whose nurses have spent a large amount of time in investigating the home conditions of these children.

From the 5th of July to the 15th of September 41 children were admitted to our outdoor school, and 40 have been enrolled at the winter school. Fifty-nine of those admitted were weighed on admission, and it was found that the children on an average weighed twelve pounds less than the normal weight for

their ages. Only ten were normal, or over weight, and two of these had been receiving out-of-door treatment and extra food for a number of months, with decided improvement. Six of these children were over 20 pounds below the normal weight for their ages, and four of the six were more than 50 pounds below the normal. The children gained on an average six pounds while at the summer school.

It has been suggested by Dr. Schoomaker, of Philadelphia, that all school-children be weighed once a month, and that those who are below weight and steadily losing be examined with special care by the school physician. This seems an excellent suggestion.

The committee realized that the results would have been more satisfactory had it been possible to have kept the children overnight. Twenty-five were questioned concerning their sleeping accommodations, and of that number only three slept alone, and in a number of instances the bedrooms were shared by more than two people.

The importance of removing a child from a tuberculous environment at the earliest possible moment was very clearly demonstrated by some work which the writer did over a year ago at an orphan asylum. One hundred and six children were given the tuberculin test, and it was found that those who gave a positive reaction were, on the average, eleven months older at the time of admittance than those who did not react,—that is, the extra year in the home increased their chances of infection,—and when there were several children from a family in which tuberculosis was known to have existed, the youngest child (that is, the one earliest removed from the home) was almost invariably the one who had escaped. In fact, among the infants coming from the same sort of homes that the older children had come from there was no case of tuberculosis detected.

The French Society for the Prevention of Tuberculosis Among Children found homes in healthy families for 250 children of tuberculous parents, and none of the children developed the disease.

We have sanatoria where those who have the disease may be cured, as the word "sanatorium" signifies. They are indispensable. But there is a crying need for "tuberculosis preventoria"—places where the children will escape infection, and where those who have a latent infection may conquer it before it develops into clinical tuberculosis.

If these frail children with tuberculosis of their bronchial glands attend school in the usual badly ventilated school-room, who can say just when they will develop "open tuberculosis" (that is, a cough with the germs in their ex-

pectoration)? And do you want your children attending school with a case of "open" tuberculosis?

Yet it is manifestly unfair to keep those children out of school. In outdoor schools, where they study wrapped in warm rugs in the winter, they become strong and hardy while getting their schooling.

Then look at the subject from the standpoint of dollars and cents. Is it worth while expending so much money each year on people who will die from tuberculosis before they reach the age of twenty?

Thomas has estimated that it costs the State of Illinois each year $1,187,000 to educate children who die from tuberculosis before they are twenty. Surely the State would get a better return for her money if they grew up; and most of them would if given a chance.

Besides the school in Hartford, open-air schools have been conducted this past winter in Boston, Providence, New York, Rochester, Pittsburg, Chicago, and Mt. Airy, Pa. New York has five schools, four of which are on old ferry-boats. Next fall will see 20 more open-air schools in New York for delicate children. Nearly 500 children were attending outdoor schools in this country during the past winter. Of them, 125 were "open" cases (New York and Pittsburg), and less than 100 were closed and "predisposed."

Mr. William E. Watt, of Chicago, has demonstrated that any child, sick or well, does better work and has better health in fresh-air rooms than in the usual heated school-room. He has an average attendance in the fresh-air rooms of about 250. Healthy children have received open-air instructions for the past four years at Mr. Airy, near Philadelphia, and they are very enthusiastic over the results.

A law has recently been passed in Boston that all new school-buildings must have provision for open-air instruction.

In conclusion: I. The time is past for sending the delicate, so-called scrofulous children, and those with tuberculosis of the bones, to the ordinary schools. Every city should have one or more outdoor schools, where these delicate children can improve their minds while their bodies are being made well and strong. Either a special building may be used, or side walls of a class-room in an ordinary building can be removed. Where the roof is flat, an excellent school-room can be arranged there, as has been done in Boston and at the Vanderbilt Clinic in New York.

II. The universal use of the skin tuberculin test in the kindergarten and lower grades will detect many cases of unrecognized tuberculosis. The home conditions of all the children who react should be investigated by the school

nurse, and in most instances an "open" case of tuberculosis will be found in the home.

III. It is very important to remove children from a tuberculous environment at the earliest possible moment. The money raised from the sale of the Red Cross stamps could not be put to better use than the establishment of these preventoria, where the children of the tuberculous can spend their vacation months.

IV. An outdoor school will usually transform the delicate child, who in the usual course of events would become a dependent invalid, into a robust, useful citizen.

V. The most important phase in the conservation of our national resources is the protection of the child. "For of thorns men do not gather figs," nor can a vigorous race spring from weaklings.

DISCUSSION ON PAPERS BY MR. NEWTON AND DR. STOLL

Dr. Howard S. Anders, Philadelphia: I believe the previous paper was not discussed, and if I may say something on that I shall be glad to do so. The question of anti-spitting legislation is one I am particularly interested in, and I wish to compliment the writer on the very comprehensive way in which he has treated the subject. I am particularly interested in this matter because I am one of the pioneer members of the Pennsylvania Society for the Prevention of Tuberculosis, which is the parent society of the kind in the world, organized in 1892. This society, a few years ago, attempted to have anti-spitting ordinances enacted in Philadelphia, or to make some attempt, at least, to check the promiscuous spitting evil; but for political and other reasons it was very difficult to get anything done. We appealed several times between 1895 and 1900 to the Councils to have them make some note of the importance of the matter and take some action. There was nothing more done except what could be done through public education, in having the people realize the dangers of the spitting habit, along the lines of antituberculosis education in general. The street-car company did, after a while, post up notices prohibiting spitting; and the railroad companies did likewise. Subsequently, attempts were made by the legislative committee of the Pennsylvania Society to have the State fall in line by enacting legislation which would make uniform the various anti-spitting ordinances that had been adopted here and there in cities throughout the State, but which were scarcely ever, if at all, enforced—Philadelphia included. The result of that was that in the last legislature, of 1909, the State Commissioner of Health, who has done splendid work along

this line personally, was clothed with authority which now makes it possible for him to enforce, through the State health inspectors, the anti-spitting legislation which was passed, except in cities of the first class, like Philadelphia and Pittsburg, and there the matter is still rather *in statu quo;* and we are obliged to depend entirely upon the efforts of the city authorities in this direction, and they are, I am sorry to say, entirely too indifferent in this respect. The Pennsylvania Society for the Prevention of Tuberculosis has had several volunteer inspectors, members of the medical profession, to make examples of violators of the spitting ordinance, and several arrests have been made in the last year; but until an ordinance or ordinances are passed and enforced along the lines of making it everywhere a misdemeanor, punishable by fine, it is not very likely that much good will be gained, except what can be gained by public opinion. In Philadelphia, at present, the ridiculous situation obtains that if we see any one violating the act, the only thing we can do is to buttonhole the man and ask him to go with us before a magistrate while he serves a warrant for his arrest. Finally, I wish to say this, that there is one fact which is usually not spoken of in connection with the enactment of anti-spitting ordinances and legislation and enforcement, and that is, the relation of street-cleaning, which, in my judgment, cannot be disassociated from it. The question of clean streets, as nearly as possible dustless and smokeless, is very important. There is no question but that many people are compelled to spit as long as the atmosphere is as dust-laden and polluted as it is in many of our large cities. When the streets of our large cities are thoroughly cleaned and the dust allayed by adequate and frequent efforts at sprinkling and flushing, there will certainly be less of this spitting evil. There are large numbers of people with catarrhal conditions that, if they have anything they can raise, they are going to spit somewhere. Of course, a great many are needlessly careless in spitting along the sidewalks, but there is no question but that the street-cleaning question does enter largely into the difficulty of enforcing anti-spitting legislation, because of the irritating and inflaming effect that a smoky, dusty atmosphere does have upon the mucous membranes.

MEDICAL AND BOARD OF HEALTH SUPERVISION OF BOARDING-HOUSES AND SANATORIA FOR THE TREATMENT OF TUBERCULOSIS

By David P. Butler, M.D.
Rutland, Mass.

(Read by Title)

Within a few months of the establishment of a large sanatorium for the treatment of tuberculosis there comes into existence a number of houses in the vicinity offering to take as boarders tuberculous patients. Naturally, at first they are very insufficiently equipped for caring for these cases properly. There is no doubt that there is a demand for such places, and they accommodate patients who, for various reasons, are barred from the large sanatorium, or who do not wish to go there, as they desire greater privacy, or in some cases less rigid enforcement of rules and regulations.

The patients in these various houses sooner or later call in some one of the local physicians who are not connected with the larger sanatorium. The physician naturally advises the housekeeper of changes to make in equipment and methods of conducting the house. Such housekeepers as follow this advice are apt to receive other patients from the physician that have been referred to him to be placed in proper environment for taking the open-air treatment. These houses speedily become the most prosperous, and are recognized in the community as the most desirable ones, and thus depend for their very existence on the way they keep up to required standards. The rates at such houses are of necessity somewhat higher than at the ordinary boarding-house.

There will, however, be some houses that do not adapt themselves to the requirement of the visiting physician, and depend for their patronage on the more or less unruly classes that will be found in sanatorium towns, and on those to whom a charge lower by a dollar or two per week appears of vital importance. It is largely with this latter class of houses that the Board of Health has most to do. In Massachusetts towns, where they do not elect a Board of Health, the Board of Selectmen constitute such a board. The Board of Health of a sana-

torium town should include one or more physicians, and because of the large sanatorium, the town itself is apt to become well known in the State as being a suitable place for the care of tuberculous patients, and for this reason the local physicians acquire more or less experience in handling this class of cases.

Cleanliness is the first thing to be insisted upon. Few, if any, of the very worst houses are uncleanly enough to be declared a nuisance by the board and closed for that reason. The Board of Health can, however, insist upon a house engaging in this business being in such condition that it may be kept clean, and in our town (Rutland) we have insisted on whole plaster, painted walls, ceilings, and floors.

The housekeeper, rather than the individual patient, is held responsible for the proper disposal of the sputum. It is rarely much of a hardship for the householder to put the house in proper condition. While arbitrary orders may be issued by the Board of Health, the more efficient work is done through personal contact of the various members of the board with the householder. There will always be some houses, however, following the letter of the Board of Health law that will allow patients to use liquor indiscriminately, to keep what hours they please, and to offer an insufficient food-supply, both in quality and quantity, and it is often surprising to note the condition of affairs even in essentials that patients will put up with in order to get their accommodations even a dollar a week cheaper.

We have found lately that the only way for a Board of Health to control this condition of things is to order that no house shall engage in the business of caring for patients without a license issued by the Board of Health. This rule was made a few weeks ago, and in granting such licenses food-supply and the general discipline observed in such houses will be taken into consideration.

The Board of Health proposes to supply all organizations in various cities that exist for the purpose of caring for more or less indigent tuberculous patients, with a list of the licensed places in the town. Compulsory notification of all tuberculous cases in town should exist, and in Massachusetts such notification as the local board receives is at once turned over to the State Board of Health.

As a rule, it does not take the average householder long to see that the higher the standard his house maintains, the surer he will be to have his rooms filled, and in truth the majority of such householders have a real interest and pride in having their houses known as those of the better class. The most of our trouble in Rutland has been from houses that were not under regular medical supervision. At those houses where it was compulsory for the patients to see

the physician at regular intervals there has been practically no trouble. The difficulty lay with those houses where the patients were permitted to see the physician only when they felt like it, which was usually on the occasion of a hemorrhage or an attack of pleurisy.

While I have not separated the statistics showing the results of work done at the boarding-houses without medical control and those under medical supervision, there is no doubt in my mind that the difference is of a startling nature. Our board feels firmly convinced that individual effort of the board among the householders is very much more efficacious in accomplishing a salutary control over these houses than arbitrary edicts issued by the board.

There can be a surprisingly large amount of harm done by several of these boarding-houses that are run loosely. This harm is done by prejudicing a certain percentage of the public against the open-air hygienic treatment, for this percentage of the public will judge that they have seen a fair average of the results of the open-air treatment in the work of these loosely run houses. One of the cruelties of the situation is that the cheaper, loosely run houses are apt to get far advanced cases, which many of the other houses will not accept, as they are not adapted to hospital work, and these poorer houses, without discipline, are least of all adapted to it, but take cases in any condition in order to fill up their usually numerous vacancies.

In the better class of boarding-houses under medical supervision the percentage of "arrested" and "improved" cases is fully as large as in the larger sanatoria. In fact, the food-supply is apt to be better, and one is better able to individualize the treatment of cases. As far as all the essentials of sanatoria are concerned, there seems to be no reason why this better class of houses under strict medical supervision should not be known as sanatoria. In fact, I consider an abundant and varied food-supply a more important requisite for a sanatorium than a well-equipped throat room or a laboratory.

One important thing for a Board of Health to insist upon is the fact that soap and a scrubbing-brush constitute the most efficient means of disinfection. The spraying of a few ounces of 5 per cent. carbolic acid in a dirty house is purely a farce.

The Board of Health of a sanatorium town should constitute itself an advisory board, and keep individually on good terms with all individuals engaged in sanatorium work. This is not a difficult task if some tact is used. Arbitrary rulings on comparatively unimportant matters entailing large expense to the householders should be avoided, as the margin of profit in all these houses is very small.

Frequent inspection of these houses should be made by the Board of Health

itself or competent agents. Another rather difficult phase in the matter is the control of those houses that take to board only an occasional patient,—houses that do not make a business of it,—and it is quite important that the sputum of patients in such houses should be taken care of and that the rooms should be properly disinfected after the patient leaves, also the large boarding-houses and hotels which occasionally receive tuberculous patients among their other guests must be looked after. These cases can be properly controlled only where the housekeeper or hotel-keeper is in sympathy with the object of the Board of Health, except in those cases where the patient has medical attendance, when the physician will, of course, report circumstances to the Board of Health.

The maximum efficiency of any board is reached only where there is sympathetic working between the proprietor of the boarding-house, hotel, or sanatorium, and individual members of the Board of Health. A Board of Health that has to enforce its regulations as regards the housing of tuberculous patients through court procedure is comparatively useless. Very occasional cases may require such methods. The majority of intelligent householders understand that a Board of Health is working in their interest.

CLINICAL SECTION

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LEWELLYS F. BARKER, M.D.

Baltimore

Secretary

LOUIS V. HAMMAN, M.D.

Baltimore

STATE PHTHISIOPHILIA AND STATE PHTHISIOPHOBIA, WITH A PLEA FOR JUSTICE TO THE CONSUMPTIVE

By S. Adolphus Knopf, M.D.

New York

This distinguished body is composed of students of tuberculosis, not only in its medical or purely clinical but also in its general or its purely sociological aspect; therefore, in presenting to them these two new phases of the conditions which confront the investigator as well as the worker, I feel that I need offer no apology. It seems to me that it is the duty of this Association to take up all problems the solution of which may tend to further our holy cause. This work includes not only the study, prevention, and cure of tuberculosis *per se*, but also securing justice for the consumptive who is persecuted or shunned because of his disease, or subjected to treatment which would not be given him were his social position a different one; in other words, it is our duty to give to the consumptive poor the same privileges and rights which are accorded to tuberculous patients in better circumstances.

For a State to enact a law that its consumptive poor must subject themselves to a certain kind of specific treatment which, up to this date, has not proved to be either efficacious or absolutely safe, and to which they would not need to submit themselves had they the means to be treated outside of State institutions, is, according to my humble judgment, an unjust, unwise, if not a dangerous phthisiophilia.

The State of Nebraska has recently passed a law from which I quote herewith the following in full:

INDIGENT CONSUMPTIVES

"4407. Sec. 4. (Consumptives, hospital care.) Any person who is afflicted with tuberculous disease of the respiratory organs of a curable nature, and who has been a resident of this State for at least one year continuously preceding the application for his or her admission to a hospital under the pro-

visions of this act, and who is without means to pay for hospital care and treatment, may be admitted to such treatment under the provisions of this act.

"4707. Sec. 5. (Board of Health—Duty.) It shall be the duty of the Nebraska State Board of Health to institute inquiry for and receive applications from hospitals in this State for the care and treatment of the persons described in Section One of this Act. It shall pass upon and make a list of the hospitals suitably equipped and managed and willing to receive patients under this act, and send a list thereof to each county clerk in the State. It shall prescribe regulations for the care, housing, and nursing of such patients and see that the same are complied with. Provided that the charge at any such hospital for any patient under this act shall not exceed seven dollars per week and shall include board, lodging, care, and medical services. Provided, further, that it is made obligatory for any such hospital or sanatorium to use the modern treatment by immunization (vaccine therapy) in addition to open-air and other sanitary methods.

"4707. Sec. 6. (Expense by county.) It is hereby made the duty of each county in this State to bear the pecuniary burden of caring for the persons described in Section One of this Act in the manner provided by this Act. Upon written application to the county judge signed by the person seeking treatment or by some relative or friend, setting forth the name, residence, and circumstances of such person, the county judge shall order a hearing and examine under oath such persons as may be required by him to establish the facts. If the county judge shall be satisfied that all the conditions named in Section One of this Act are fulfilled, he shall approve the application in writing and certify the same to the county board of that county. It shall thereupon be the duty of the county board to provide for transportation of such person to some hospital in the State approved by the State Board of Health and willing to receive such patient, and to pay for his or her care and treatment there. Provided, no person shall be cared for under the provisions of this Act without a certificate from a practising physician that such person is afflicted with tuberculous disease of the respiratory organs of a curable nature."

I call your attention to paragraph 4707, Section 5, which defines the duties of the Board of Health in cases of incipient consumption. The last paragraph reads: "Provided, further, that it is made obligatory for any such hospital or sanatorium to use the modern treatment by immunization (vaccine therapy) in addition to open-air and other sanitary methods."

When, some time ago, a Dr. J. H. Tyndale, of Lincoln, Neb., wrote me that he had caused a law to be passed which made vaccine therapy obligatory in the treatment of indigent consumptives throughout Nebraska, I could not believe it possible. I called the attention of our distinguished Executive Secretary, Dr. Farrand, to the matter. His inquiries confirmed that such a bill had really been passed by the Nebraska Legislature and is now a law on the statute book of that State.

To learn the opinion of some of my distinguished colleagues on this subject I addressed a letter of inquiry to them and asked for an answer to the following question:

Do you believe that the studies, experiments, and achievements in tuberculous immunization, tuberculous vaccine, or serum therapy, up to this date, entitle any federal, State, or municipal legislature to make immunization or vaccine therapy obligatory in cases of patients who, because of their poverty, had been obliged to enter a federal, State, or municipal institution for treatment and care?

Every one of the thirty-six gentlemen to whom I had addressed the letter of inquiry honored me with a reply. Let me first read to you the answers from some of the men to whom, I know, all of us look up as teachers and leaders.

Professor A. Jacobi, the Nestor of American physicians, whose eightieth birthday we are going to celebrate within a few days, who is as bright and keen of intellect and full of bodily vigor today as the youngest of us, and whose love for his profession, whose devotion to humanity and civic duty should forever be an inspiration to us, has said:

"The plan to force a treatment which is not generally approved—far from it—is inconsiderate: and as the patients are poor and helpless, inhumane. The belief or opinion of an individual practitioner who happens to be influential with legislators should not weigh against established knowledge and common sense."

Professor Edward G. Janeway, who honors us by presiding over our general meeting this year, answered with a decided "No." And the same reply I received from Professor Barker, who honors us by being the Chairman of our Section.

Professor William Osler of Oxford, after answering with an emphatic "No," added:

"I am glad you are doing something in this matter. It is an outrage to ask people to subscribe to such nonsense. Why not test all the members of the Nebraska legislature with tuberculin? Fifty per cent. of them would react. Your paper should do a great deal of good."

Dr. Edward L. Trudeau, the pioneer of the sanatorium treatment in this country, and one whose researches in bacterio-therapeutics in tuberculosis are accepted as authoritative, replied:

"It seems difficult to understand how any State can make compulsory any treatment of disease, and more especially a treatment like tuberculin in tuber-

culosis, the benefit of which is as yet an open question and which is not at all generally accepted by the great majority of the profession. There is not the slightest proof, either clinically or as derived from the evidence given by animal experimentation, that tuberculin immunization means immunity to tuberculosis, and it will be some years before the exact value of tuberculin as a therapeutic agent and its best method of application are definitely settled."

Professor Hermann M. Biggs, the pioneer and indefatigable advocate of public measures in the prevention of tuberculosis, through whose efforts so much has been accomplished in the municipal control of the disease, said: "Any law requiring tuberculous persons to submit to the use of a specific therapy is absurd."

And here is what our beloved Professor Wm. H. Welch, whose authority on the subject of sero-therapy nobody would wish to question, says in reply:

"I do not believe that our existing knowledge warrants the State to enact legislation making obligatory treatment of pulmonary tuberculosis by specific immunization or vaccine therapy in institutions supported or aided by the State."

And as next in order of replies from this galaxy of great men, permit me to mention the most illustrious pupil of Professor Welch, Dr. Simon Flexner, the Director of the Rockefeller Institute, and discoverer of the antimeningitis serum. He wrote:

"I desire to state that I do not believe that we possess, at the present time, an experimental or observational basis which suffices to justify any federal, State, or municipal legislature in prescribing any form of specific treatment for tuberculosis."

For the sake of brevity I will merely quote the most striking sentences from the remaining answers, avoiding repetitions as far as possible.

Dr. Howard S. Anders, Philadelphia: "The application of such procedure in democratic America especially, by governmental coercion instead of individual voluntary choice or sanction, is surely unconstitutional, and savors even of the brutal and mediæval spirit."

Dr. Edward R. Baldwin, Saranac Lake: "The Nebraska law is absurdly preposterous, unenforceable, and if not unconstitutional, ought to be."

Dr. Sidney F. Blanchet, of the Adirondack Cottage Sanatorium: "I don't see how any legislature could pass such a law, and especially how they could insist on patients taking the vaccine invented by a doctor belonging to that State."

Dr. Sherman G. Bonney, Denver: "I do not think you can be too emphatic in denouncing such legislation."

Dr. S. Solis Cohen, Philadelphia; "The idea would be ludicrous were it not so serious."

Dr. George Dock, New Orleans; "I cannot understand how any federal, State, or municipal legislature can order immunization or vaccine therapy for any patients. While observations by competent men are highly desirable in these lines, indiscriminate experimentation would be utterly misleading and altogether inhumane and unwarranted."

Dr. Henry B. Favill, Chicago: "There is no evidence to show that serum treatment adds any factor of benefit in a large percentage of curable cases."

Dr. G. Walter Holden, Denver: "I consider the experimental stage of vaccine or serum therapy in tuberculosis has not been passed as yet."

Dr. Theodore C. Janeway, New York: "I feel very strongly that no legislative body can possibly be in a position wisely to prescribe the form of treatment which shall be used in any institution for the care of sick persons."

Dr. Herbert M. King, Liberty, N. Y.: "Our present knowledge of the subject, and the experimental data at present available, by no means justify such an act."

Dr. Edward O. Otis, Boston: "I do not believe that there is any form of vaccine therapy known today that will immunize a tuberculous patient."

Dr. F. M. Pottenger, Monrovia, Cal.: "While I believe as firmly in the power of tuberculin, when given properly, to increase the immunity of patients suffering from tuberculosis as a surgeon believes in the ability of the knife to remove operable conditions, yet I do not think that federal, State, or municipal legislatures should make the tuberculin treatment obligatory by law. I believe this should be left entirely to the medical heads of the institutions."

Dr. Theodore B. Sachs, Chicago: "The function of the government in reference to communicable diseases lies in the enforcement of measures of prevention. A selection of any particular method of treatment is the inalienable prerogative of the patient, in so far as the application of the method does not interfere with the interests of the community."

Dr. W. S. Thayer, Baltimore: "My answer is obviously 'No.' No other answer could be given by any one who is in the least familiar with the studies, experiments, and achievements of tuberculous immunization."

Dr. Victor C. Vaughan, Ann Arbor: "That's right, pitch into them. My attention was called a year ago to a law passed by the Legislature of Nebraska. I certainly do not believe that any form of vaccination therapy for tuberculosis should be forced upon any one."

Dr. H. Bascom Weaver, Asheville: "The science of medicine has not so

far arrived at that stage of perfection which, in the person of one Dr. J. H. Tyndale, would justify a legislative body in the enactment of a statute compelling a person to submit to his method of administration of a substance of unknown scientific purity and efficacy."

The following gentlemen simply answered the question in the negative: Dr. W. Jarvis Barlow, Los Angeles; Dr. Frank Billings, Chicago; Dr. P. M. Carrington, San Diego, Cal.; Dr. Thomas D. Coleman, Augusta, Ga.; Dr. R. H. Fitz, Boston; Dr. David R. Lyman, Wallingford, Conn.; Dr. John H. Musser, Philadelphia; Dr. William Porter, St. Louis; Dr. A. Alexander Smith, New York City; Surg.-Gen. Geo. M. Sternberg, Washington; Dr. T. M. Tyson, Philadelphia; Dr. Gerald B. Webb, Colorado Springs.

It is possible that among my hearers there may be some who will say that it was not worth the while to go to all this trouble. Nebraska is only one State, and this Association is not responsible for peculiar State legislation. For a little while I was almost inclined to take the same view, but in the February number for 1910 of the "Zeitschrift für Tuberkulose" there appears an article entitled "Der Kampf gegen die Tuberkulose in den Vereinigten Staaten," written by Dr. Ernst Schultze, of Groszborstel. On the whole, this article is flattering to the efforts made in this country to combat tuberculosis effectually, but when I read the two concluding paragraphs, I felt a sense of shame and humiliation.

I do not care to reproduce here either in the original nor in the translation the terms used by Dr. Schultze in condemning the Nebraska law and its author. Those who care to read the original can find it in the article I have referred to. As for myself, I do not quite like such strong terms as he uses, nor do I think them just. I would rather believe that Dr. Tyndale was moved in this matter by unselfish motives, though he evidently erred, but it is our duty to let the world know that we do not approve either of his methods or of such State legislation.

The second paragraph in Dr. Schultze's report relates to an incident of medical politics which, as an American physician, I cannot allow to stand unchallenged. I will give you as exact a translation of this statement as possible: "By 'medical politician' in the United States ('aerztlicher Politiker') there is not to be understood a man who, by political means, desires to further public health, but, on the contrary, a man who has received his office in the health department for political reasons, and utilizes this office for his personal gain. For example, let me relate the following: Such a medical politician in South Carolina received a delegation of physicians asking him to further certain hygienic reforms and indorse, in his official capacity, the proposed legislation relating thereto. He frankly replied, 'Why do you want to create laws to pre-

vent people from becoming sick? Do you not realize that if you do so you cannot make any money?'" Dr. Schultze maintains that such sentiments are not rare in the United States, and that with us the medical politician is a by-word. He furthermore makes the statement that only one-fourth of our State Health Departments do their duty.

I am not in a position to question this statistical statement, but even if the incident in South Carolina is true, I wish to state that in my somewhat extensive dealings with health officials I have never heard any one in public office express similar sentiments, and I do not believe that the incident could possibly be duplicated. With all the faults of our relatively young civilization, the American medical profession has upheld its ideals, and I think as far as the observance of a high medical code of ethics is concerned, the American medical profession compares favorably with that of other countries.

I come now to the second portion of my paper, which, in contradistinction to phthisiophilia—an excessive or overcare for the consumptive on the part of the State—I call State phthisiophobia. I believe that I can best explain this as an exaggerated fear on the part of the State authorities of the presence of consumptives. That the fear of the consumptive in this instance should not be a fear of the ordinary consumptive, rich or poor, and ignorant of the necessary precautions, but a fear of the consumptive physician, and that it should have originated among physicians enjoying health and prosperity, is, in my opinion, one of the saddest manifestations of this the most cruel type of phthisiophobia which it has ever been my misfortune to observe during well-nigh twenty-five years of life in the midst of consumptives of all degrees of intelligence and social positions, in various climes in this country and abroad.

As in the case of the Nebraska legislature, I did not care to rely on rumors, on one man's tale, or on newspaper information. That any State legislature could be so narrow-minded, unjust, and prejudiced as to refuse to grant a license to practise to a physician because he is afflicted with tuberculosis is almost beyond comprehension, and I could and would not believe it until I had absolute evidence.

A distinguished physician of New York, whom I have had under my care for a number of years, wrote to Dr. F. P. Davis, the Secretary of the Board of Medical Examiners of the State of Oklahoma, asking for information concerning the formalities he would have to comply with in order to receive a license which would entitle him to practise medicine in that State. Incidentally, he mentioned that he was slightly afflicted with tuberculosis. The doctor was good enough to send me the original reply, which I have in my possession. It reads as follows:

STATE OF OKLAHOMA
BOARD OF MEDICAL EXAMINERS
Frank P. Davis, M.D., Sec'y,
Enid, Oklahoma.

Members:
Dr. W. T. Tilley, Muskogee.
Dr. H. C. Montague, Muskogee.
Dr. A. M. Chambers, Poteau.
Dr. D. W. Miller, Blackwell.
Dr. F. P. Davis, Enid.
Dr. A. M. Butts, Holdenville.
Dr. L. E. Emanuel, Chickasha.
Dr. A. R. Lewis, Ryan.
Dr. J. Hensley, Oklahoma City.

December 7, 1909.

Dear Doctor:

Replying to your favor of the 2nd. This Board does not grant license to physicians who are afflicted with tuberculosis.

Enclosed you will find a copy of the affidavit attached to all our application blanks, also copy of instructions which will give you the desired information.

Any further information will be gladly furnished.

Very truly yours,
(Signed) Frank P. Davis,
Sec'y State Board of Med. Examiners,
A. E. S.

The most marvelous piece of evidence of this new type of phthisiophobia, which might be called professional phthisiophobia, is the tuberculosis affidavit which must be sworn to by the applicant and signed by another Oklahoma physician who has examined him and reported him as free from tuberculosis. Here is an exact copy of the blank in my possession, with which my tuberculous colleague was furnished:

TUBERCULOSIS AFFIDAVIT

I further state that I am not now suffering with tuberculosis in any form; that I have not in the last three years lived in the house with or nursed any one suffering from said disease. That I have not opened an office or began practice in the State of Oklahoma, and will not do so until I will have received the proper authority from the State Board of Medical Examiners.

.....

Subscribed and sworn to before me this day of 1909.

.....

I, ... a legally qualified physician in the State of ....., have been acquainted with ....., whom I know to be the same person making an application to which this is attached; that I have known for three years, and have made a thorough examination and find to be free from tuberculosis.

My State license is No. .....

Subscribed and sworn to before me this day of 1909.

.....

Think of the absurdity of asking any physician to make a statement that during the last three years he has not lived in the house with or nursed any-one suffering from said disease! How many physicians in any large city, obliged to live in large apartment or flat houses, could swear to such a state-

ment, and how many of us general practitioners or specialists who treat tuberculosis and who are so fortunate as to call a little house their own, would wish to swear that during the last three years they had not nursed any one suffering with tuberculosis?

The modern phthisiotherapeutist does not do much else but nurse his patients. The administration of medicine is certainly of minor importance. The words "nursed any one suffering from tuberculosis," as used in the affidavit, can mean nothing very different from treating tuberculosis. If it meant strictly that the physician should not have performed the duties of a trained nurse, then the Oklahoma legislature is making a serious mistake in not also excluding from service in that State all trained nurses who may have taken care of a tuberculous patient during the last three years.

What would our tuberculosis science be today if Brehmer and Dettweiler, who were both tuberculous, would have been forbidden to practise medicine in Germany? If Finsen, of Norway, would not have been allowed to practise in his country? If Laennec, Bichat, and Grancher would have been forbidden to exercise their profession in France? What if Solly would not have been permitted to enter and practise in Colorado? or our own Trudeau, Baldwin, and Brown could not have gotten a license to practise in New York? The examples are too numerous to continue.

Have the men who promulgated this cruel law ever thought of the thousands of men, and women, and children who were restored to health and usefulness because men like Laennec, Brehmer, Dettweiler, Finsen, Grancher, and our own much regretted Solly, McGahan, and others have lived? Do the men in Oklahoma know what we owe to men like Trudeau and his co-workers, Baldwin, Brown and others, who are daily laboring among the tuberculous, though they themselves have been afflicted with the disease? Have they forgotten that Trudeau, twenty-five years ago, though afflicted with a seemingly hopeless pulmonary tuberculosis, built the first sanatorium, and that, as a result of his example and teachings, we have today in the United States nearly 400 of these life-saving institutions? Have these colleagues of ours in Oklahoma ever thought of the fact that by excluding physicians afflicted with tuberculosis from their State they will increase the fear of tuberculosis in their community to a most dangerous degree, and further phthisiophobia among the masses, thus rendering the life of the average consumptive a hundredfold more unhappy than it is already?

But it may interest my hearers to know what the opinion on this question is, not of men who, because of their physical illness may feel too sensitive to answer the question, but of men who are not tuberculous and who certainly

could not be accused of being personally interested in this peculiar phase of phthisiophobia. I have asked a number of our leading practitioners in various parts of the country whom I know to be healthy and hearty and not afflicted with tuberculosis the following questions:

Will you have the kindness to express to me your opinion regarding the justice, humanity, wisdom, and scientific basis of the action of the State Board of Medical Examiners of Oklahoma which excludes tuberculous but otherwise well-qualified practitioners from practising in Oklahoma?

Will you also please express your opinion regarding the affidavit, of which I inclose an exact copy, and which must be sworn to by every practitioner and signed by another practitioner already a resident of that State before a license can be granted to him to practise in the State of Oklahoma?

To these two questions the answers were likewise most interesting, decisive, impressive, and in some cases burning with indignation. For the benefit of our Oklahoma colleagues, I reproduce a number of the statements expressed by men of the highest standing in our profession.

I will follow the same order I used in reproducing the replies regarding the Nebraska matter:

Dr. A. Jacobi: "The stipulations contained in the Oklahoma arrangement are simply ludicrous. They are the outcome of gross ignorance, and open the door to whimsical jealousy on the part of the practitioners of Oklahoma. The whole thing is a sort of shot-gun quarantine. Try to stop the mischief threatened by uninformed people and criminal exclusion."

Dr. Edward G. Janeway: "I think that is a very oppressive measure, and one not either humane or just. As regards the affidavit, I think that is an additional oppression, especially the part which requires the practitioner to say 'he has not lived in a house with a consumptive or nursed any one suffering from the disease.' These measures, it seems to me, are ill calculated to advance the best interests of the struggle against tuberculosis."

Dr. William Osler: "I would apply the von Pirquet test to all the medical examiners of Oklahoma, and those who reacted might be asked to leave the State. The tuberculous affidavit is absurd."

Dr. Hermann M. Biggs: "The action of the State Board of Medical Examiners in excluding tuberculous practitioners is absolutely unjustifiable. It seems to me incredible that such a law as apparently exists in Oklahoma could be enacted by a sane body of men."

Dr. Wm. H. Welch: "I regard the action of the State Board of Medical Examiners of Oklahoma, as indicated in your question and expressed in the copy of the 'Tuberculosis Affidavit' accompanying your letter, as ill-advised, unjust, and inhuman."

Dr. Simon Flexner: "I would emphatically state that I do not believe that it is just or desirable that any physician, whether tuberculous or not, should be subject to the restriction which is placed upon them by the act mentioned, empowering the Board of Medical Examiners of Oklahoma to exclude them from the practice of their profession. I, therefore, regard the affidavit which is required under this act as being both unjust and superfluous."

Dr. Howard S. Anders: "I cannot understand the science, wisdom, or justice of such action in Oklahoma or elsewhere. I think the affidavit borders on impudence, and manifests an attitude of undignified distrust of the professional knowledge and responsibility."

Dr. Edward R. Baldwin: "I think our medical confrères on the continent were quite justified in their satires, and it will be hard for them to understand that ridicule of this kind does not involve the great majority of the medical profession of the United States. Nevertheless, I reiterate my opinion that the Oklahoma law excluding tuberculous practitioners could not be enforced against an appeal, and I submit to any crossroads lawyer that such a thing as quarantine legislation is open to very wide ranges of interpretation. Of course, it is annoying and would require a fight, but I understand Oklahoma has even passed laws specifying the length of sheets in hotel beds! These are all in the same class with the law proposed to prevent the marriage of tuberculous patients."

Dr. Lewellys F. Barker: "(2) Unwise and inhuman: to question (3), Disapprove."

Dr. Frank Billings: "It is malicious and unjust. Such an affidavit is unjust to an individual suffering from tuberculosis, and equally to a physician who desires to practise in the State of Oklahoma. It looks like an attempt on the part of the medical profession of Oklahoma to exclude practitioners from settling in the State."

Dr. Sidney F. Blanchet: "I am very glad to hear that you are bringing these questions up at the next meeting, and hope that something will be done to make such legislation as that of Nebraska and Oklahoma impossible. It seems outrageous."

Dr. S. G. Bonney: "As in the Nebraska matter, you cannot be too emphatic in denouncing such legislation."

Dr. S. Solis Cohen: "The Oklahoma ruling has no scientific basis. The affidavit is neither necessary nor just. It is not founded on knowledge, but on ignorance—not on wise caution, but on senseless fear."

Dr. Thomas D. Coleman: "Such laws, whether enacted in Oklahoma, New York, or Georgia, should be submitted to review by the United States Supreme Court."

Dr. George Dock: "It is difficult to answer these questions in anything

like a cool manner, but I shall do my best. I can see neither justice, humanity, nor wisdom, and no scientific basis whatever, for the action of the State Board of Medical Examiners of Oklahoma, which excludes tuberculous or otherwise qualified practitioners from practising their art in Oklahoma. The copy of the affidavit is so absurd that it is impossible to describe it in polite language. I do not suppose it is constitutional; but if it is, do not see how any self-respecting practitioner can enter the State to practise or subscribe to the affidavit having entered it."

Dr. Henry B. Favill: "With regard to the question, the problem is much broader, and it is strictly an ethical question. Shall a State because it desires to give itself a certain undeniable advantage in the personnel of its medical faculty, take a position which, if taken by all States and all communities, would be in the highest degree ill-advised and unsocial? On that broad proposition, I should say that this provision in the laws of Oklahoma is shortsighted and unwise. Furthermore, the cause of the antituberculosis crusade in my judgment would be retarded by such general policy for at least two reasons: First, it fosters an unreasonable fear of tuberculosis, which, among intelligent people, should not exist. Second, it is likely to deprive a community of the highest type of medical minds which tend to concentrate scientifically and ethically upon this great problem."

Dr. R. H. Fitz: "I consider it undesirable to restrict the practice of medicine to physicians free from tuberculosis in any form."

Dr. G. W. Holden: "Unjust, inhuman, and a disgrace to the intelligence."

Dr. Theodore C. Janeway: "I do not see how there can be two opinions about the inhumanity of the provision of the State Board of Medical Examiners of Oklahoma. I should think it probable that the unwisdom was equally incontestable, for it will merely serve to exclude a very small proportion of tuberculous individuals from the State and accomplish nothing in the way of effective quarantine, which, from the nature of tuberculosis, is a wholly impossible undertaking in any event. I am exceedingly glad you are going to take up the matter before the National Association."

Dr. David R. Lyman: "I should think the profession in Oklahoma should be ashamed to go on record as being afraid to enter into competition with the practitioners of other States who are already laboring under the handicap of tuberculosis."

Dr. John H. Musser: "The law is just in one sense. If all classes are treated in this manner, the physician must take his chance with the others. It is unjust when we know of the labors of Trudeau, etc., etc. It should be amended so that the physician would be compelled to obey restrictions or hygienic regulations. Extremists on contagion theory of tuberculosis must support this first portion of the affidavit. It is the outgrowth of our insistence. The other (relating to the three years, etc.) is silly."

Dr. Edward O. Otis: "Unjust, unwise, and unnecessary, and I doubt if it can be enforced. The whole principle is wrong, and such a step will not, in my opinion, tend to eradicate tuberculosis in Oklahoma. The affidavit is most selfish and narrow, and is evidence of a low standard of intelligence among the profession and people of Oklahoma. Furthermore, it is obviously easy to evade the requirements by collusion and false swearing. It would be interesting to know what body of officials devised such an affidavit."

Dr. William Porter: "Unjust, cruel, unnecessary. Such ignorance and foolishness is paying tribute to selfishness. I am glad you will denounce it."

Dr. F. M. Pottenger: "Such a procedure cannot help but foster an unjust prejudice against the tuberculous. The affidavit which is required to be signed by the applicant cannot help but arouse our sympathy, both for the applicant who is unjustly treated and for the framers of this affidavit, who show such a total lack of appreciation of tuberculosis and its real dangers. I do not question the motives which inspired this affidavit, but its wisdom and scientific basis certainly are very questionable."

Dr. Theodore S. Sachs: "Medical training, familiarity with methods of prevention, and the fully developed sense of civic responsibility make the physician the most important factor in the fight against every communicable disease, tuberculosis included. This is particularly applicable to the tuberculous physician all over the world. In the universal fight against consumption, which is saving in this country thousands, tens of thousands of people, the tuberculous physician was always and is at present in the vanguard of the procession. No State has any right to exclude any one suffering with tuberculosis, the stricken physician in particular. Very few people could conscientiously sign the Oklahoma affidavit, with its ridiculous provisions."

Dr. A. Alexander Smith: "A most unjust and unwise movement on the part of the State Board of Medical Examiners of Oklahoma. The affidavit is unjust. It is in line with the misdirected efforts now being put forth in the fight against tuberculosis. Such legislation is bound eventually to do harm to the cause."

Surg.-Gen. Geo. M. Sternberg: "In my opinion physicians suffering from incipient tuberculosis, or arrested cases, should not be prevented from practising their profession. Advanced cases would not be able to continue in practice, and legislation upon the subject is unnecessary and is likely to prove mischievous. The tuberculosis affidavit is a ridiculous and unnecessary exaction."

Dr. Wm. S. Thayer: "I can see no earthly ground for the exclusion of such practitioners; many of the greatest advances in the study of tuberculosis have been done by tuberculous individuals. No one is so able to illustrate the necessary means of precaution as he who has been obliged to learn for himself. Think of the lives Trudeau has saved. With regard to the affidavit you have inclosed, I can only say that I know of no human being who could be justified under any circumstances in subscribing to either. It would be stupid

to pretend for a minute that any one could say with certainty that he himself, or any other individual, is free from tuberculosis. Let me thank you for taking hold of the matter which so closely affects the public."

Dr. James Tyson: "Unjust, inhumane, and unwise. Affidavit unreasonable and unnecessary."

Dr. Victor C. Vaughan: "I think that the physicians of Oklahoma need a drubbing, and I know very well that you are the man to give it to them."

When I first read of this cruel phthisiophobia about a year ago, I had my doubts as to the genuineness of the report. After its verification I prepared a paper which I read before the American Medical Association under the title of "A New Type of Phthisiophobia." It was published in the Journal of the Association, No. 13, vol. liii, and as a result I received a number of interesting letters wherein physicians in the prime of health and prosperity and others afflicted with tuberculosis expressed to me their gratification. It would, of course, be out of place to incorporate all such letters in this communication, but still there is one which is so full of meaning and pathos that, with your kind permission, I will read it:

"Dupuyes, Montana, October 14, 1909.

"*Dear Dr. Knopf:*

"Thanks, much thanks, for that 'New Type of Phthisiophobia.' I almost missed it, and disgust was changed to anger at the silence of the profession.

"Are you alone protestant? Has the medical profession become a wilderness, with but one voice? I wish you would tell a grateful exile of any other. If there is none, you shall have at least one echo.

"Yours gratefully,
(Signed) "C. N. Burke."

The preceding answers to my letter gave an expression of opinion on this subject, and the sentiment which will be expressed by this Association at large, I am sure, will convince our unfortunate exiled colleague that he and all our colleagues afflicted with tuberculosis, as well as the consumptive poor and those of all other classes, have in the members of this Association true friends and sympathizers, and that our highest aims will forever be *justice to the consumptive.*

[In view of the opinions unanimously expressed by a large number of the influential members of our Association on the dangers, the injustice, the inhumanity, and last, but not least, the unscientific spirit expressed in the State phthisiophilia and State phthisiophobia described in the preceding pages, with

the documentary evidence attached thereto, the following resolutions were unanimously adopted by the National Association for the Study and Prevention of Tuberculosis at its meeting in Washington in May, 1910.

Referring to the Oklahoma law:

WHEREAS, The Board of Medical Examiners of the State of Oklahoma refuses to grant licenses to physicians afflicted with tuberculosis; and

WHEREAS, All applicants for such a license must subscribe and swear to a so-called tuberculosis affidavit in which they must not only declare that they are not suffering with tuberculosis in any form but also swear that they have not, within the last three years, lived in the house with or nursed any one suffering from said disease; and

WHEREAS, In the opinion of the members of this Association such action of the State Board of Medical Examiners of Oklahoma is not based on sound scientific or economic consideration; and

WHEREAS, It is the conviction of the members of this Association that neither the careful tuberculous physician nor the well-trained tuberculous patient pursuing his occupation should be considered a menace to society. Be it therefore

Resolved, That this Association deplores the action of the State Board of Medical Examiners of Oklahoma as unjustifiable and prejudicial to the best interests of the community, and

Resolved, That the Executive Secretary transmit a copy of these resolutions to the President and Secretary of the Oklahoma State Board of Medical Examiners and to the Governor of that State.

Referring to the Nebraska law:

WHEREAS, The State of Nebraska has recently passed a law making it obligatory for hospitals and sanatoria receiving tuberculous patients supported by the public to use treatment by immunization (vaccine therapy); and

WHEREAS, In the opinion of the members of this Association the present state of knowledge of specific immunization and vaccine therapy in tuberculosis does not justify any State in enacting such legislation; therefore

Resolved, That the National Association for the Study and Prevention of Tuberculosis deplores the above-named act of the State Legislature of Nebraska as most unwise and wholly unjustifiable. Be it further

Resolved, That the Executive Secretary of the Association transmit a copy of these resolutions to the Governor of the State of Nebraska and the speakers of the Senate and the House of Representatives of that State.]

DISCUSSION ON DR. KNOPF'S PAPER

Dr. John S. Fulton, Baltimore: Dr. Knopf has been kind enough to send me a copy of these two laws, which was my first information on this subject. I will start by saying that they are samples of bad legislation, and there is, therefore, no room for what we would call discussion. There is not much room for consideration—none, as far as I am concerned, in my decided opinion as to the nature of the two laws. However, they are not equally bad. I mention first the regulation, apparently, of the Oklahoma Board of Medical Examiners. That is not a law,—not a State law,—but it has the force and effect of law as controlling the admission to license of medical practitioners from outside the State. I do not understand that this applies to medical practitioners within the State or to candidates from within the State; is that right?

Dr. Knopf, New York: All those applying for license to practise medicine in the State of Oklahoma.

Dr. Fulton: Then the restraint is upon those who begin the practice of medicine in Oklahoma and those who wish to transfer the scene of their activities from some other State to Oklahoma. Now, this question opens up the whole matter of occupation of tuberculous persons, and while we condemn this law rather strongly, we need not put on airs about it, because we are hustling the tuberculous wage-earners in various ways practically all over the country, not always under force of law, but by other just as onerous modes of prohibition. Perhaps what it signifies is the desire of Oklahoma, first, to keep consumptives out of their State; secondly, to prevent consumptives from beginning the practice of medicine, and I think you will have to admit at the outset that that is rather a different proposition from a proposition to exclude medical men already practising from practising on account of their having contracted tuberculosis. It is at least a defensible proposition that the medical schools might be called upon to exercise some foresight, and not to start young men or men of any age with tuberculosis into the practice of medicine. That is an entirely different proposition, it seems to me, from a proposition to exclude those who have been unfortunate enough to get hurt in the risk which their calling necessitates. This is also an act of the medical profession apparently. It is a regulation by the Board of Examiners of Oklahoma. Is it written into the organic law of the State?

Dr. Knopf: I do not know.

Dr. Fulton: Apparently not. It is a most oppressive measure, and it is an absolutely impractical measure. Manifestly, it will keep consumptive

physicians out of the State of Oklahoma, and if Oklahoma desires to do that, it seems to me it is within her right to effect that in some way or other. At all events, we have certainly got to consider the question of the constant moving of tuberculous persons into the settlements of the west and southwest. It is not easy for us to settle that question here. There are some parts of Texas and two or three territories in the southwest where great claims have been made for the climate, and the immigrant consumptive is not only a very serious menace, but a very heavy economic burden; and while we all do protest these drastic measures, they have a certain, if not justification, at least extenuation, in the fact that we allow consumptives to travel in numbers into those regions.

To my mind the law in Nebraska is unqualifiedly bad, and does not quite fit my idea of phthisiophilia, because it is, as far as it possibly can be, from a friendly act to consumptives as a class to compel them to undergo any specified treatment of any sort. All of you must remember the Keeley cure, which had a great vogue in this country a few years ago. Perhaps some of you have forgotten that a large number of the States made the Keeley cure obligatory, to be inflicted by a magistrate, and there were Keeley-cure hospitals in a number of States. There was one in my own community, and it survived for five or six years. This law in Nebraska could easily be attacked and upset. As it stands, it is to my mind a monstrous piece of legislation. It is an extremely injurious piece of legislation, and both of the measures call for censure—one for an unqualified disapproval, and the other, to my mind, for a very vigorous disapproval, on the part of this Association.

Dr. Ira van Gieson, New York: I think it is rather late in the day for us to wake up and recognize this almost mediæval cruelty to tuberculous patients, regarding them as lepers. We have all known of it for several years. Dr. Knopf has given a very good public expression of it, but it seems to me that we go right on encouraging that idea; and whose fault is it? One of our greatest inherent weaknesses is to shift the blame on other shoulders, if we can find some one else or something else to blame for what is our own doing. I think that physicians have been laying too much stress on the bacillus, and we have raised up fanatics throughout the country in this legislation, and the consequent result has been for the public to regard the consumptive as a leper. We ought to recollect, I think, that not only have we individual cases to treat, but we have in our care the public mind in matters of legislation. Now it is perfectly true that there is no tuberculosis without the tubercle bacillus; it is also equally true there is no tubercle bacillus without the tuberculous patient. What are we fighting? Are we fighting the tubercle bacillus or tuberculosis? There is somewhat of a distinction. It

has been said that every man is the architect of his own fortune. Every man is also more or less the architect of his own tuberculosis, and we should teach people to overcome this disease, which is universal, and it seems to me almost omnipresent.

Dr. Knopf: I only wish to say one word in reply to Dr. Fulton's remarks: it is not the medical student who is about to begin the practice of medicine, but the medical practitioner, who is excluded. Those of you who have heard the reading of the form of affidavit required will recall that the applicant must say that he has not nursed such a patient for three years. Now, a medical student usually does not do that. He is a student only, and not a practitioner. I thoroughly agree with Dr. Fulton that it would be most judicious to require that every student entering on the study of medicine should be examined, so that he should not undertake this great task handicapped, and I most emphatically indorse this practice, which I know is in vogue at the Johns Hopkins Medical School. I cannot conceive of anything more unfortunate than for a young physician to start out in life handicapped by so serious a disease as tuberculosis; but many of our colleagues have contracted tuberculosis in their performance of duty. Surely, there cannot be anything more cruel, inhumane, and unjust than to exclude these unfortunate physicians from practising and thus earning their livelihood. We all know that the ordinary patient can be trained so that he can associate with any one without the least danger. How much more true then is this of the physician who has superior knowledge of hygiene and prophylaxis?

THE TEACHING OF TUBERCULOSIS—A PLEA FOR ITS SPECIALIZATION IN MEDICAL SCHOOLS

By A. P. Francine, M.D.

Philadelphia

By way of introduction it may not be out of place to make a few remarks about clinical teaching in general, which are logically pertinent to the more specific question of the teaching of tuberculosis. It will be generally admitted that the highest function of undergraduate medical teaching is to make good doctors. In this latter term is implied scientific attainments and attitude of mind, breadth of view and interest, capability for constructive work, and the moral force and character which lead to success in practice. The necessity for the pure scientist or research worker in medicine must be recognized, but the function of undergraduate medical teaching cannot be considered as strictly directed to the production of this type.

In the production of the former type, medical education or teaching pursues two broad lines—one is rendered possible by laboratory facilities and is concerned with laboratory teaching; the other is rendered possible by clinical facilities, the hospital, and is concerned with clinical teaching. It goes without saying that these are so interdependent and correlated, or should be so, as to form two indispensable and component parts of one harmonious whole.

This admirable combination, so fully appreciated today, is, however, a relatively modern development; for previous to 1880, and even later, laboratory facilities for the training of students did not exist in this country, nor, indeed, to any great extent in Europe. But it was in Continental Europe, particularly in Germany, that the modern laboratory idea had its inception and its first development, and it has since been adopted in this country quickly and to full measure.

But even with the advent of the laboratory, medicine continued for a considerable time—certainly up to within a generation—to be taught largely along clinical lines; and to a certain extent at least laboratory facilities and laboratory teaching were neglected or their value underestimated. But

influenced by foreign views, the importance of laboratory teaching gained ground with enormous strides, until today we have far outstripped Europe in laboratory facilities for the instruction of students. In the best type of our medical schools students spend much more time in laboratory work than is the case in Europe. Indeed, it is this phase of our medical teaching and this phase of our general equipment which surprises most the visiting scientist from abroad.

The question must arise, however, as to whether we have not in a certain sense come to exaggerate and develop this phase of medical teaching at the expense of more strictly clinical instruction, and whether the pendulum has not, as it seems inevitable that it should always do, swung too far over. There would seem the danger of our making of laboratory teaching a fetich and displacing it from its position of fundamental and collateral importance into that of an ultimate rôle or goal. This surely is beyond its function in a medical curriculum, for its chiefest aim and object is its service to clinical education; and, however important it may be in itself, it must always be subservient to, or bear this relation to, clinical teaching.

Remarkable as it may seem, the tendency to overestimate the value of laboratory teaching does not come altogether from the laboratory man. As a matter of fact, the best type of laboratory man is much fairer and more justly appreciative of the true place of laboratory teaching than many of the internists; and it would almost seem as if the latter were led or influenced by the fear of being considered unscientific should they fail to be overzealous of the laboratory idea; indeed, there is also the possibility that a certain amount of their enthusiasm is bred of the charm of the unknown, and that this high-browed zeal is the cloak of a good deal of ignorance.

It may not be entirely out of place to insist that a good piece of clinical work is quite as scientific in principle as a good piece of laboratory work, and that the best type of clinical teaching is just as scientific as the same type of laboratory teaching. As has been well said:* "At present many physicians look on the work in the laboratory as scientific because certain phenomena are here more carefully analyzed perhaps than seems possible in a clinic or at the bedside. But the spirit of true practical medicine is scientific. Its aims are utility and service to mankind. Facts are being observed and correlated and their meaning determined. The apparatus may be different, but the methods are fundamentally the same as those of the laboratory. Why should an accurate physical examination of a patient be less scientific, for instance, than the chemical analysis of the blood or observations on the

* Editorial, *Jour. Amer. Med. Assoc.*, November 14, 1908.

biology of the tubercle bacillus? The ultimate aim is the same, and though the end in view in the former is more immediate than in the latter, the difference is not such as to justify calling one scientific and the other non-scientific."

The further question arises whether laboratory facilities and laboratory teaching, having increased so rapidly, have not now reached a satisfactory stage of development; have not, as it were, come to their own, and whether it is not time to advocate greater hospital facilities and better methods of clinical teaching. The foundation for clinical teaching in most medical schools is and should be the hospital of the school. Other hospitals may, to a certain extent, and in some instances to a large extent, be made use of, but it is the hospital of the medical school that must bear the brunt of the greatest service. Enlargement and increased hospital facilities have not kept pace with the foundation, equipment, and maintenance of laboratories for teaching, and this has been due not only to the immediate need for this newer arm of the service, but also to some extent, I believe, because special efforts have been given to raising money for the latter purpose, and that it requires, generally speaking, less money.

There is one branch of clinical medicine which has attained a position of first importance, dating from 1880, the time of the beginning of the laboratory movement, and in a way dependent on it. I refer, of course, to tuberculosis. For not only has this subject increased enormously in scientific interest, but there have been created splendid hospital facilities for its study and teaching. It seems hardly necessary today to argue about tuberculosis having become a specialty. It is widely so recognized by both the profession and laity; the only place where it is not fully established as such is in our medical schools themselves, and this only as regards teaching.

It would be interesting in this connection, did time permit, to review the gradual emancipation of the other specialties from the two parent chairs of medicine and surgery. Certain of these branches of medicine had won their freedom before the beginning of medical teaching in this country, one hundred and forty-five years ago; others have followed throughout the years; while in our own day new departments are being from time to time created, indicative of later advances and needs. But these are strikingly along experimental or research lines, and the necessity for this must be generally apparent. Indeed, it may generally be admitted that when the need for such foundations have appeared manifest, they have been made. And it is further true that the clinical specialty of tuberculosis has barely established itself on a proper and

scientific basis, so that its wait has not been a long one, for already there are signs of its proper recognition, as I shall point out later.

It is only since the discovery of the tubercle bacillus and the establishment of the unity of all tuberculous processes that tuberculosis became in itself a science or special branch worthy of the name. Previous to this it was only one disease, and as such properly belonged to the teaching of general medicine. That it has developed out of this position today must be admitted, as witness its scientific progress, its enormous literature, its clinical study, difficult and exacting, and its popular interest, all of which make it as great and far-reaching and important a specialty as any of the other clinical branches of medicine.

It has, therefore, passed the stage where it can be adequately taught except by those who have given it special study. This is particularly true on account of want of facilities for its study and teaching in a general medical service, as these cases have not been admitted to general hospitals. Thus, material for ward-class instruction and clinics is not, strictly speaking, available outside of special institutions. It must, therefore, be taught from such special institutions, be they dispensary or hospital, and it must of necessity be taught by the men in charge of such service. It goes without saying that these should be sane and scientific men who have not only given this subject special study, but who have also had broad experience in general medicine. There has been in the past too often some reason for the reproach that the so-called tuberculosis expert is not as well trained along general lines as he might be, and is apt to be a faddist and somewhat dangerous in his precepts. But there is growing up today a large group of younger men who approach the study of tuberculosis from a scientific and broader point of view. To such men we must look for the future development of this specialty along clinical lines, and upon such men we must rely for its clinical teaching in our medical schools. Finally, in this connection let me insist that the great mass of younger men who are strictly engaged in teaching internal medicine cannot properly teach tuberculosis, either from the point of view of its theory or practice, because they cannot, in the nature of things, give to it adequate special study, and because they lack clinical facilities.

In regard to the facilities necessary for the proper teaching of tuberculosis, they are twofold, and, as in internal medicine, they consist in the dispensary service and the wards. For when I speak of teaching tuberculosis, I do not mean alone the demonstration of physical signs, the teaching of physical diagnosis from cases of pulmonary tuberculosis,—that can well be done from a tuberculosis dispensary service,—but I mean also teaching the different phases of the disease itself, its protean types and manifestations, its relation

to broader medical problems and conditions, and the inspiring of students with a knowledge of its scientific interest and progress. Indeed, it would be just as futile and limited to attempt to teach tuberculosis from a tuberculosis dispensary service alone, as to attempt to teach internal medicine from a medical dispensary alone.

Tuberculosis has reached a position where it should be taught to both third and fourth year students in our medical schools. As it is essentially a special branch of internal medicine, this amounts simply to amplifying and increasing the facilities and time for the clinical teaching of medicine. To the third-year men it could well be taught in the tuberculosis dispensary. Here should be taught history taking, the physical signs and symptoms, the physical diagnosis of the disease, its sociological aspects and general management. In this way the student would come to the tuberculosis wards in the fourth year with at least a working knowledge of physical signs and a certain familiarity with the usual type of cases—as is not now the case.

The fourth-year men in most of our medical schools are largely ignorant of tuberculosis, incapable of diagnosing it in its incipiency, and of properly interpreting the lesions in more advanced cases; and many of them graduate without ever having seen and studied adequately a single case, and only having received the most scant and casual didactic instruction in this important subject. It is not now generally thought of at all as part of the curriculum. If a case happens to present in the medical dispensary service, it is perhaps used for ward class to a small section of students, while the other sections may go through their entire course in internal medicine and never see a case. And even when clinical material may be available, there is no effort to teach this important subject systematically, and to the full extent its clinical importance warrants.

In the fourth year students should receive instruction in tuberculosis wards, where they could see and study the broader aspects of tuberculosis, the many interesting and complicated phases of the disease, the effect of tuberculosis on the other organs and tissues of the body, the displacements of intrathoracic relations, its localization, classification, types, etc., and where possible, should follow the cases to the postmortem table.

This plan need not entail a great deal of time. From my experience I would suggest that each of the medical subsections in turn should have one ward class a week in tuberculosis for one period of the session, so that every student in the class would get a certain amount of practical instruction—the third-year men in the tuberculosis dispensary, and the fourth-year men in wards for advanced cases.

It may be of interest in this connection to outline briefly the character of instruction in tuberculosis which has been given at the University of Pennsylvania during the past session, 1909–1910, which is a considerable advance on anything heretofore attempted at the University, and I believe, generally speaking, elsewhere. This consisted in a systematic course in tuberculosis given to the fourth-year men at the Philadelphia General Hospital, with its unequaled service of 250 beds, in which practically all types of cases from the earliest to the most advanced can be found. Two consecutive hours a week were allotted to this teaching; the first hour was devoted to a clinical demonstration and conference in the clinic room of the hospital, and then the section, which consisted of a third of the class, was taken into the wards, and spent the remaining hour in the individual or bedside study of cases. Each section, which numbered about 45 men, came for a third of the academic year, and for purposes of ward class instruction was subdivided into three subsections, there being three instructors engaged in giving the course. In this way each section of a third of the class had about ten or twelve clinics or clinical talks in which the subject of tuberculosis was presented in an orderly and systematic sequence, with ample clinical material available for demonstration and text; and, further, every man had the opportunity of studying cases individually in the wards in an equal number of small ward classes. This course met with the most faithful attendance and hearty interest on the part of the students.

While this is not a great deal of time and effort to give to tuberculosis, yet it may be safely said that were some such plan more generally adopted by medical schools, there would soon disappear the practitioner of medicine who overlooks cases of pulmonary tuberculosis or who is unable to understand the manifestations, prognosis, and management of these cases in their later stages.

Surely it is not asking too much that our medical students be given an adequate opportunity to study and learn something of this disease, that they be taken into tuberculosis wards and dispensaries and study this splendid material, which is, broadly speaking, if properly used, an education in clinical medicine in itself; for no two cases are just alike, and there is no phase or complication of tuberculosis which cannot be found in such a service.

DISCUSSION ON DR. FRANCINE'S PAPER

Dr. S. A. Knopf, New York: The plan outlined by Dr. Francine is a very interesting one, and I do not wish to criticize it. There is

only one point I believe he has overlooked, and that is the value of sanatorium instruction. Now if I had my way I would have every graduating student during his last year make at least half a dozen visits to some sanatorium, and there let him see the most approved modern methods of hygienic and dietetic treatment of tuberculosis in application, so that when he goes into the practice of his profession he will have an idea how he may apply the sanatorium treatment at home, and will know that when he cannot adopt it then he should send the patient to such an institution. There are any number of cases that cannot be sent to sanatoria, and it is his duty to know something about the most approved methods of hygienic treatment at home. In other words, he should be a master of the application of sanatorium treatment at home, and then he will be much better able to cope with the disease. While I believe in specialization, still it is the general practitioner who, as Dr. Osler says, is the "man behind the gun" in the conquest of tuberculosis, and it is he who must be thoroughly trained. Now he only has a chance to see patients in the dispensary or the ward for advanced cases; he should also see the opportunities and facilities we have for the treatment of early cases, which, as you know, are the most hopeful of all.

Dr. E. O. Otis, Boston: I would simply like to emphasize the value of what Dr. Francine has told us today with regard to the special teaching of tuberculosis in our medical schools. It has been my privilege for the last six or eight years to have a Department of "Pulmonary Disease and Climatology," as it is called; but nine-tenths of my instruction is devoted to the teaching of tuberculosis in class and clinical work. I have the students of the last half of the third year and the first half of the fourth year, and my work largely consists of clinical instruction in tuberculosis and the diagnosis of cases of that disease. I do not believe that when the teaching of tuberculosis is confined to general medical clinics, sufficient time can be devoted to the subject to enable the young practitioner to be successful in diagnosing early tuberculosis or in managing tuberculosis. I do believe that we have arrived at a time when we should require a special department in our medical schools to teach tuberculosis with a special tuberculosis dispensary where early cases can be examined. Curiously enough, the greatest objection in the establishment of special departments in medical schools for teaching tuberculosis seems to come from the general internist. I remember, it was something like ten or twelve years ago, when I was attempting to establish a special dispensary for tuberculosis in the general dispensary with which I was connected, that the greatest opposition was from the men who had charge of the general medical clinics. And I do not think that the general

internist yet appears to be ready to admit that the specialist on tuberculosis can make a better diagnosis than he can, or make a better disposition of the cases. When the time comes that the general practitioner will admit this, we shall then see in our medical schools special departments for the teaching of tuberculosis.

Dr. Wilson: I have had special opportunity to bear witness to the truth of every question brought up by Dr. Francine. I have had charge of the teaching of clinical medicine to the graduating class in a fairly large school for the past two or three years. During this time I have had about one-fifth of the class doing special work in the tuberculosis dispensary. The other four-fifths did not get the benefit of that special work. They have also had oral examinations given by myself, and I have been interested in this question of how much they know about tuberculosis, and I find that those who had the benefit of the tuberculosis dispensary, and the special teaching in it, had a knowledge of it, both from a practical and clinical standpoint, that the other men in the class did not have; and you could not say that those men who had had such advantages were any better mentally than the rest of the men in the school. After this experience, I must say that the need is great for the establishment of a separate department of phthisiology, not entirely separate from general medicine, but remaining under the general supervision of the professor of medicine, but having a special staff and rooms.

Dr. J. H. Elliott, Toronto: I am glad to hear Dr. Francine's remarks in regard to opportunities for teaching pulmonary diseases, particularly tuberculosis, in the wards of their general hospital. I think there can be no doubt but that the young men going out to practise medicine must have special instruction in the diagnosis and treatment of pulmonary tuberculosis. Some cities have special consumptive hospitals or sanatoria in the neighborhood where the classes can be taken for this special instruction, but I think Dr. Francine's class is particularly fortunate in having the material close at hand in the wards of their general hospital. Again and again we ring up nurses and ask them to take such a case, and they say, "Oh, no! we don't take tuberculosis cases." Some of these nurses have been trained in hospitals where no tuberculosis cases are treated; such cases are sent to other institutions, and those nurses know nothing about the care of tuberculosis. Now in sanatoria tuberculosis is not spread to the attendants or to the physician or to the nurses, and I am sure no hospital and no board of directors will acknowledge that they are going to be less careful than the superintendent or directors of a sanatorium. And where it is possible, why cannot our general hospitals set apart one or more wards for the care of tuberculosis, particularly in the

teaching schools, so that the students may become acquainted with the diagnosis and treatment of tuberculosis? Then the nurses graduating from such a general hospital will know something, at least, about the treatment of tuberculosis.

Dr. J. Girdwood, Baltimore: I have recently tried, in one or two papers, to emphasize the responsibility of the doctor in tuberulcosis. Personally, after an examination of the conditions in the State of Maryland, I believe that the incipient cases must necessarily first come to the attention of the family physician; and, personally, I feel that the majority of practising physicians have not had sufficient education or sufficient instruction in tuberculosis to recognize those incipient cases, and consequently their treatment is deferred until the cases are far advanced. Any effort to correct that condition should have the support of this Association.

Dr. Francine: There have been some very interesting points brought up by this discussion. I agree with Dr. Knopf entirely in what he has said, but it seems to me that we will have to wait a little for it to come to pass. What we need now is to teach the practical facts about tuberculosis, about the diagnosis, as emphasized by Dr. Otis and Dr. Wilson. Medical students come to the fourth year and even graduate without being able to diagnose tuberculous lesions. They are not familiar with the physical signs. They cannot differentiate clinically between different types or stages of the disease. They have had very little training or experience in pulmonary diagnosis, and it seems to me, from the point of view of medical education, that that is an important element for the medical schools to teach. I think, with Dr. Knopf, that it would be a fine thing to take these men into sanatoria and dispensaries and teach the sociological aspects of the disease and its treatment, but the point I would like to emphasize is the necessity for training in diagnosis. You have to teach students to diagnose these cases before you can teach them to handle them. The diagnosis is logically and scientifically the first step. In regard to nurses, that too is a very valuable suggestion. In order to handle a case properly nurses must have special training and experience. As suggested by the last two speakers, it would be well for nurses to be taught to get over the fear of contracting tuberculosis, which is, of course, not very well founded.

PROGNOSIS OF TUBERCULOUS LESIONS INVOLVING THE WHOLE OF OR MORE THAN ONE LOBE

By Joseph Walsh, M.D.

Philadelphia

Three years ago Dr. Stanton called my attention to the fact that cases of tuberculosis of the lungs with large lesions (lesions involving an amount of tissue greater than the right upper lobe) usually did better when these lesions were on the left than on the right. As soon as the idea was mentioned, I realized that I could recall more patients who were doing well with large lesions on the left than on the right, but I withheld full agreement until I made further study. Further study confirmed this idea, and in the discussion of the "Heart in Tuberculosis" and of "The Primary Location and Development of Tuberculosis in the Lungs," before the meeting of the National Association in Washington, May, 1909, both Dr. Stanton and I mentioned the fact. It was not until this year, however, that I made a complete study of my private cases with this point in view.

Out of 1500 private cases of tuberculosis of the lungs, I found only 67 with large lesions which I had seen over a sufficiently long time to make positive statements in regard to the exact involvement and the result. A study of these cases shows the following:

COMPARISON OF THE RESULTS IN CASES WITH LARGE LESIONS ON THE LEFT AND RIGHT SIDES.

Involvement.	Result.		
	Good.	*Fair.*	*Bad.*
Left upper lobe	1	2	3
Left lung	0	1	1
Left upper lobe and probably right apex	1	2	1
Left upper lobe and right apex	6	2	0
Left lower lobe and right apex	1	0	1
Left lung and right apex	2	2	0
Left upper and upper part of lower lobe and right upper lobe	2	0	0
Left lung and right upper lobe	1	0	2

Involvement.	Result.		
	Good.	*Fair.*	*Bad.*
Right upper and middle lobes	3	1	7
Right upper and upper part of lower lobe	0	0	2
Right upper and lower lobes	0	0	1
Right lung	0	0	4
Right upper lobe and possibly left apex	2	1	0
Right upper lobe and left apex	3	0	0
Right upper and upper part of middle lobe and possibly left apex	1	0	0
Right upper and middle lobes and possibly left apex	0	1	2
Right upper and upper half of left upper lobe	1	1	0
Right upper and middle lobes and upper half left upper lobe	0	0	3
Right upper and upper part of lower lobes and upper half left upper lobe	1	0	0
Right upper lobe and two-thirds left upper lobe	0	2	0
Summary { Large Lesions on Left	14 (45 per cent.)	9 (29 per cent.)	8 (26 per cent.)
Summary { Large Lesions on Right	11 (31 per cent.)	6 (17 per cent.)	19 (53 per cent.)

This table shows that even when we compare lesions of the right upper lobe with those of the left, the latter are more favorable, though the comparison is not exactly fair, since the left upper lobe is considerably larger than the right. If we omit, as we should have done, lesions confined to the right upper lobe, that is, lesions not affecting the right middle or lower lobe, the cases with large lesions on the right would stand as follows:

Involvement.	Result.		
	Good.	*Fair.*	*Bad.*
Large lesions on right	5 (19 per cent.)	2 (8 per cent.)	19 (73 per cent.)

In addition, further study of the individual cases shows that there was no coincidence of character or environment favoring the left-sided cases, but, on the contrary, the surrounding circumstances favored the right-sided cases. Even the fact that in the cases with bad result we included no case that died of an accident like hemorrhage, pyothorax, or pneumothorax favored the right-sided cases.

In the classification of the results, good result means that the patient is well and has been pursuing his ordinary occupation for a period of from two to five years, except in two cases, which have been working only seven months; fair result means that the patient has been well for one year, but is unable to work; bad result means that the patient has died or is hopelessly sick in bed.

Taking everything into consideration, therefore, I have no hesitation in

thinking that large left-sided lesions more frequently give good results than large right-sided ones.

Dr. Stanton's personal statement at the National Association meeting last year was as follows: "I have long been convinced that a large left-sided lesion offered a better prognosis than a large right-sided lesion. The kind of a case I refer to is familiar to every one working in tuberculosis. One rather frequently sees patients with complete left-sided involvement with râles over both lobes and the apex-beat palpable and visible as far out as the left anterior axillary line. The right chest in these cases is usually much larger than the left, and has a much greater amount of motion. Such patients often have a practically normal pulse-rate, and are able to do nearly the normal amount of work. While such a case as this is not uncommon, I have never been able to find a patient with the same amount of involvement on the right side who was able to get even a moderate amount of strength."

Dr. Stanton's original explanation of a possible cause for the better prognosis was: With large left-sided lesions the heart is drawn to the left, but this displacement is merely a drawing to the left, and disturbs in no way the normal relation of the heart and vessels to each other; when, however, the heart is drawn to the right by a large right-sided lesion, the relation of the heart to the vessels is disturbed by the heart turning on itself instead of merely allowing itself to be drawn in a normal position. This turning over of the heart so that the apex, instead of pointing to the left, points to the right, twists the vessels, with the consequence that extra work is put on the heart. This extra work on the already overworked heart is what changes the prognosis from favorable to unfavorable. This explanation appealed to both of us because we realized how much the heart has to do with making the prognosis favorable or unfavorable. During the past year, however, in a careful study of the hearts of 75 autopsied cases dying of tuberculosis of the lungs, we found that the heart never did turn on itself, and when displaced to the right, it appeared to be displaced as far as we could see in practically the same fashion as when it was displaced to the left. This explanation, therefore, fell to the ground.

A second explanation, which I thought might mean something, and which I stated last year at the meeting of this Association, is that large right-sided lesions usually represent an acute or a subacute progression of the disease, with little or no resistance, and large left-sided lesions are usually in cases which have advanced on account of causes not connected with the disease, like environment, etc., and which show that their susceptibility to tuberculosis is not great by the fact that they have already cured or practically cured a lesion at the right apex. The frequency of these cases is due to the frequency of the primary lesion being at the right apex.

In the study last year of the primary location and development of tuberculosis I tried to show that clinical tuberculosis of the lungs has its primary seat more frequently at the top of the right than at the top of the left lung; that this lesion usually heals or almost heals, throwing about itself a special resistance, and if, for any reason, further dissemination occurs, it is usually implanted at the apex of the opposite lung. In exceptional cases the individual is too susceptible or the lesion too virulent to admit of healing, and the process extends acutely throughout the whole or a large part of the upper lobe, or even of the lung on the first side. In other exceptional cases, after half healing at the apex, the resistance of the individual disappears, the half-healed lesion breaks down, and continues to advance on the same side. In the first or usual way of development the prognosis is better than in either of the latter ways.

Or to state it differently, on account of the frequency of the primary lesion at the right apex large right-sided lesions usually represent an acute or a subacute progression of the disease without resistance; large left-sided lesions usually represent a secondary development in not very susceptible cases, and are, therefore, more easily cured. Moreover, this explains some of the discrepancies we have found, for although, as a rule, large left-sided lesions give a good prognosis, there are exceptions to this rule, as is very evident in a study of the table, which are not to be explained by the mere extent of the lesion.

A further study of the table shows that the cases which gave the best results were those in which there was a large lesion on the left, with chronic involvement of the right apex, or a large lesion on the right with chronic involvement of the left apex; while the cases that gave the majority of bad results were cases with large lesions on the left without any lesion on the right, or cases with large lesions on the right without any lesion on the left.

Rearranging the table we find a large lesion in one lung, with none in the other in 26 cases, a large lesion in one lung and a doubtful lesion in the other in 11, and a large lesion in one lung and a small or medium sized lesion in the other in 30. Omitting the middle category, since the lesions are not positive, we have:

COMPARISON OF THE RESULTS IN CASES WITH A LARGE LESION IN ONE LUNG ONLY, AND A LARGE LESION IN ONE LUNG WITH A SMALL OR MEDIUM-SIZED LESION IN THE OTHER.

Involvement.	Result.		
	Good.	*Fair.*	*Bad.*
Large lesion in one lung only.....	4 (15 per cent.)	4 (15 per cent.)	18 (69 per cent.)
Large lesion in one lung, small or medium-sized lesion in other lung.....	17 (57 per cent.)	7 (23 per cent.)	6 (20 per cent.

There have been several pathological papers written to show that the primary lesion of tuberculosis in the lungs is as frequently at the top of the left lung as at the top of the right, among which one of the most recent and most conclusive is that of Adami and McCrae, before the International Congress on Tuberculosis in Washington in 1908.

Out of 1000 cases autopsied, 417 showed evidence of past or present tuberculosis in some organ. Of these 417, 100 cases showed small areas of calcification or fibrosis in the lungs, in other words, small healed lesions; 72 cases showed small areas of caseation, but without recent activity; in other words, latent disease. In these 172 cured or practically cured cases the lesions were slightly more frequent on the left than on the right. The writers do not state the frequency with which the different sides were involved by the more advanced lesions; in other words, their statistics are strictly limited to pathological lesions.

In this paper, however, I am considering clinical lesions. I would be unwilling to consider a case with a cured tuberculous wart on his finger as a cured case of clinical tuberculosis, and in like manner am unwilling to consider a spontaneously cured single tubercle in the lung as a cured case of clinical tuberculosis. As the situation of the tuberculous wart depends not on the greater susceptibility of the right or left hand, but on the accident of inoculation, so I believe such tubercles as they describe in the lungs may be due to the same cause. Despite the pathological findings, therefore, I believe that clinical tuberculosis, that is, tuberculosis in cases with some susceptibility, begins more commonly at the top of the right lung.

In addition, a study of the progression of tuberculosis of the lungs on autopsies at the Phipps Institute showed that in the cases in which it was possible to judge the progression, the progression commonly corresponded to what I have pointed out as the most fatal clinically; in other words, the majority of the cases showed progression practically throughout one side before the other was involved. I do not wish to emphasize this fact, however, since this study of the progression from a pathological standpoint was not very satisfactory on account of the number of cases in which the progression could not be judged.

In the discussion of this subject last year the idea was suggested that the cases of large involvement which did so well might have been cases with thickened pleura instead of actual lung involvement. In answer to this I would say that practically all the cases presented in this paper, especially those with very large lesions, were examined not only by me, but by others (Dr. Flick, Dr. Stanton, etc.), and after the past seven years' experience with autopsies in which

we have seen our clinical diagnosis practically constantly confirmed, I am not willing to grant even the possibility of this.

In addition, I might add that I have studied the cases from the standpoint of cavity formation and other special features in connection with both the disease itself and the circumstances of the patient, like age, sex, environment, etc., and have found nothing further to account for the better result in the left-sided cases.

CONCLUSIONS

I. Lesions involving the whole of one lobe of the left lung usually give better results than lesions of the same size in the right lung. One reason for this appears to be that the large lesion on the left more frequently represents the secondary development in a somewhat resistant case.

II. Lesions involving an amount of lung tissue the size of the left upper lobe give a better prognosis when the opposite side shows a chronic healed lesion.

THE RESPONSIBILITY FOR RELAPSE OF TUBERCULOUS PATIENTS AFTER DISCHARGE

By W. L. Dunn, M.D.

Asheville, N. C.

While we can find much cause for gratification in the immediate results of the treatment of the tuberculous, we must view with concern the large number of relapses occurring among those discharged as arrested or apparently cured. Our faith in our results and in our methods compels us to search for some reason why the relapsed many have not remained as well as have the unrelapsed few. When a period of quiescence can be so readily brought about, why can it not be continued indefinitely?

It must be borne in mind that we are dealing with the chronic form of a disease characterized by alternating periods of activity and quiescence, which vary in length and degree with the virulence of the infecting organism and with the natural resistance of the individual as modified by his social, work, and hygienic habits. The course of the case relapsing after treatment does not differ from that of the untreated one, save that in the former the length of a period of quiescence is much longer because of the care he has received. This is so evident that we are compelled to consider the relapsed case simply in the light of one in which a natural period of quiescence has probably been greatly exaggerated as a result of treatment. But why does this period of "arrest" which has existed for one or five years not continue throughout the patient's natural life?

Some explanation of this can be found in the nature of the disease itself and in its immediate and remote effects upon the individual whose low natural resistance made the original infection and first period of activity possible. The physical instability of the individual after infection is well evidenced by the quick gains and losses which occur in weight. That the nervous equilibrium has also been greatly disturbed is clear from the well-known effect of mental shock or of worry in causing rise of temperature in an arrested case without any signs of activity. The vascular and associated kidney degenerative changes

so commonly observed as a result of the prolonged intoxication, or possibly of the high protein diet, or both, interfere so seriously with the subsequent general nutrition and physiological balance as to lessen the resistance to the bacillus. Scar change and the consequent interference with the blood and lymph circulation probably impair the nutrition and possibly reduce the resistance of the tissue in the immediate neighborhood of the inactive fibroid focus, with its ever-ready horde of bacilli. Fibroid contraction in old areas, organized pleural exudates, and adhesions cause thorax changes which affect aëration and circulation in remote areas. The more extensive the areas of involvement, the more intense the activity, and the longer the standing of the disease before arrest, the greater will be all these changes and their influence upon the local and general resistance of the individual. Indeed, the sum-total of these alterations is so important that in the absence of other cause it is quite conceivable that a reinfection of a "*real* cure" might take place from bacilli which had been left behind, just as a patient might be reinfected by the typhoid bacilli which had continued to inhabit his gall-bladder. But inasmuch as these are all a part of the life history of the individual and of the disease, or are the natural and unavoidable consequences of the activity of the bacillus and its associates before the arrest has been accomplished, we need not concern ourselves about them except where such injuries can be diminished by the modification of our methods of treatment.

Especially good opportunity for the study of relapsed cases is to be found in any much-frequented health resort. These cases very commonly place the blame of their downfall anywhere but on their own shoulders, with the result that the fight is taken up the next time in another place and with another doctor. True, the resort physician sees comparatively few of his own relapses, and doubtless often thinks he does not have as many as his distant colleague, whose work he knows only by relapsed cases, but any idea of great superiority is quickly modified by an effort to trace cases discharged by himself five and ten years previously. A careful study of such cases which may come under one's observation during a period of years gives some data, a little exact information, and many impressions as to what may be the cause of the seemingly unnecessary frequency of these relapses. It is, therefore, largely impressions to which the writer presumes to direct your attention for a few minutes, and at the risk of some repetition the responsibility for relapses will be considered under that incurred by the patient, by the physician, and by the methods of treatment.

A careful study of relapsed cases is very interesting and clearly shows that the responsibility cannot be laid at the door of any one person or thing, and that in many instances the downfall was entirely unnecessary and avoidable. It

would be a serious error to look for causes of these relapses only after the date of the discharge, because the real cause is not infrequently to be traced to a time long before the cure has been completed, or even before the development of the disease itself, in the character of the patient, sometimes in his home and childhood training. Just as strength of character is one of the most important factors in the fight against the disease, it is one of even more importance in holding a result after it has once been obtained. Although occasionally a patient without earnestness of purpose and without moral backbone may get an arrest of his disease, he is usually one of the first to enter the ranks of the relapsed. Spoiled adults, like spoiled children, make bad patients. The person who has not learned the lesson of self-sacrifice and forbearance in his childhood or before the development of his disease is not apt to learn it during the course of his treatment, and enters into his after-life totally unfitted to meet those temptations to work and to play which must be resisted if he will continue in his state of arrest.

One of the greatest misfortunes that can befall many is the return of the feeling of well-being, either early in the course of treatment or before the arrest has been assured. This is, indeed, a very dangerous period for every patient, for it is then that this feeling of well-being is accentuated by contrast with his preceding illness, and that his inactive life seems wholly unnecessary or without definite purpose. It is then that financial necessities seem most compelling, that ambition burns as never before, or that folly calls him from the monotonously inactive life of the cure to the old joys and associates of his former life. In consequence the course of treatment is very commonly cut short before the period of arrest has been reached or the result has been safeguarded, which, with a sudden turning from a life of rest to one of strenuous activity, is frequently responsible for a relapse. Freedom from penalty for first and minor indiscretions paves the way for more and much greater faults, which are ultimately disastrous.

The patient upon his discharge very commonly does not comprehend the true nature of his result; he either frankly calls himself "*a cure*," or nurses in his heart the fond idea that he is *now cured*—that he can now say he *once had* tuberculosis. This overconfidence in his result is responsible for many indiscretions, and encourages him in not properly safeguarding his life. In his efforts to make up for lost time, to regain his position with his former associates, to retrieve losses, or to meet the debts made necessary by his illness, he makes a sudden return to his full work or to his old habits of life. This is more or less necessary because he is compelled to compete with those who are not handicapped by any physical disability. This makes the proper use of his

working hours impossible, as any husbanding of his strength marks him a weakling, for whom there is no place in our strenuous business life. The directions and precautions given him upon his discharge as to the use of his working hours cannot be observed, whether he will or not, except at the risk of his position, which now means more to him than it ever has before. It is not only his immediate bread and butter, but because of his previous physical disability and of the present-day fear of tuberculosis if he loses it, it is by no means easy for him to secure another position. His greatest fault in his after-life, however, is not the improper use of his working hours, but is his failure to devote the sixteen or more idle hours of the day to right living and to the safeguarding of the result which he has obtained at such a cost.

The more we study these cases, the more we are driven to the conclusion that the physician must shoulder part of the burden of blame. The physician has either not possessed the personality properly to inspire his patients with the right spirit in their fight, or he has not thrown enough of himself into the work to infect them with his enthusiasm and interest. It is too often forgotten that the period of treatment is a training school to teach the patient not only how to get well, but, even more, how to *stay* well. Unless the patient has been properly impressed with the idea that what he does while under the physician's observation is of infinitely more importance than that which the doctor does, it is not strange that after discharge he will not regard his own acts and his own life as important in the maintenance of his result. His discipline during his treatment must not be confined to those things which are necessary to his immediate improvement, but to affect his after-life must go further. Many things which might not be positively or at all harmful during the time he is under care must be forbidden because permission of minor indiscretions during treatment gives license after discharge.

It is surprising how many patients are dismissed without proper instructions as to their after-life, as to the kind of work they are to do, and how they shall do it. It is so easy to say, "get a light outdoor job," which to the desk-worker means manual labor, for which he is totally unfitted either by training or in body; besides there is a limit to the light outdoor jobs from which a man can earn a living for himself and family. They have not had it impressed upon them that with the gradual return to their former lives there is an equal or even greater necessity for care than ever before. Many patients are cautioned against the improper use of their work hours, but have not been given a single word of instruction about the immensely more important remaining idle hours which may be devoted to right living and to keeping well. It is not at all uncommon to find a patient who has religiously lived the life up to the date of

discharge, who has returned to his work, disregarded his former rules of life, and gone back to his unventilated bedroom all in a single day.

The discharge of the patient before an arrest has been certainly reached, or before it has been safeguarded, is another cause of some unnecessary relapses. The rule in some institutions that a patient shall not remain longer than a certain number of months is evidently quite necessary, but is, nevertheless, responsible for the too early discharge of many cases as "apparent cures" or "arrests." The physician in private practice very commonly does not hold his patients under care sufficiently long because of the fear of the imputation of holding, for the sake of gain, a patient who looks well, feels well, and believes he is well. Sometimes the physician is a busy man and does not take the time and trouble to oppose the restive patient who is insistent upon returning to his family, to his work, or to his play. He realizes that the only reason he can give for his opposition is that of caution, although the watchword of our whole fight is to err on the side of extreme caution, because it is on the side of safety.

In some instances undoubtedly too much weight is placed upon the general appearance of physical health without a proper consideration of the local lung condition and of symptoms. On the other hand, it is evident that the physician may be too easily satisfied with the disappearance of certain physical signs. This is particularly true of the adventitious signs. Again, it must be admitted that some patients are held unnecessarily long or sometimes have their lives unwisely restricted because of the persistence of râles in small or large areas. Still, by far the greater blame of the doctor lies in being too easily satisfied with the evidences of arrest than the contrary.

Some of these relapses might have been avoided had the patients been kept under watch for the first few years after discharge, not so much for evidence of relapse in their disease, as for relapses in their habits and care which are pretty certain to foreshadow the former. Control examinations by another physician than the one who treated the patient, however, are often worse than useless, for many times the examination is made by a careless examiner or by one unfamiliar with the signs and the areas of involvement during the activity of process. Flattering reports of the patient's condition, with some such stock phrase as, "I will pass you for a $10,000 insurance policy," are too common. Sometimes the doctor has not got the heart to tell the patient that he fears that there are signs of beginning relapse; at another time he is congratulatory of the former physician's excellent results, and thus paves the way for indiscretions by making the patient overconfident.

But of all the responsibilities of the physician, perhaps the most important

comes from the use of that very dangerous and fallacious word—"cure." True, we know what we mean by the word "cure," but the patient does not know that we have a mental set of quotation marks about the word whenever we use it in this connection. The patient hears us speaking of the curability, or possibly of the easy curability, of tuberculosis; he knows this word only in connection with such diseases as measles, typhoid fever, pneumonia, smallpox, and the like. He congratulates himself upon the fact that he has already had one or more of these diseases, to the list of which "has beens" he now adds tuberculosis, and says with increased pride: "In addition to typhoid fever and measles I *have had* tuberculosis." It would never occur to him to say "*I have*" a disease of which he has been "*cured.*" And just so long as we use the word "cure" in connection with this disease it will be quite impossible to make the discharged patient understand or say that he still has a disease of which he is "cured". It requires a feat of mental gymnastics of which the average mind is quite incapable.

It must have struck some that the case discharged as unarrested frequently outlives, by many years, the case discharged as "cured," because he has been impressed with the idea that he was, is, and will continue to be tuberculous, and has acted and regulated his life accordingly. It would seem that the patient's greatest safety might lie in his recognizing the essential incurability of the clinically demonstrable case of tuberculosis and in our teaching this to our patients. The patient who is taught to say "I have tuberculosis" instead of "I had tuberculosis" will continue to safeguard himself against indiscretions, will continue to safeguard others by the proper care of any sputum and by taking suitable precautions in his relations with family and associates.

Dangerous overconfidence is of growing frequency among tuberculin-treated patients who have an exaggeration of the idea of the protection against relapses afforded by use of this remedy. While we recognize that tuberculin does reduce danger of relapse, we must not forget that this is not great enough to justify unregulated optimism on part of either doctor or patient.

To place any of the blame upon the method of treatment would be a tacit admission that it were a fixed routine without consideration of the requirements of the individual case. However routine any of us may make our treatment of patients, we would scarcely care to admit that this was the case. It is, nevertheless, quite apparent that some of the phases of the methods in use are sometimes misused or abused. For instance, nearly every one can recall a relapse which dated from an interference with nutrition resulting from forced or overfeeding, while under treatment, or which was continued after discharge. This, however, is an error much more frequent in the past than at present, for the

feeding of a patient beyond his powers of assimilation and to the point of a damaged digestive and eliminative apparatus is comparatively rare with those who are making a special study of the treatment of the tuberculous. But this cannot be said of many who are just beginning to give these patients attention, for the first step into this field is not infrequently marked by a routine order of two quarts to a gallon of milk, together with eight to twelve eggs a day, in addition to a liberal meat and fat diet.

There is in some instances an altogether too great exaggeration of that very essential step in the treatment—the rest cure. As important as the rest cure may be at certain times, and particularly at the beginning of the course, it is of equal importance that it should be modified or abandoned at a later period. The folly of returning a case at his discharge from a rest cure directly to his former life hardly admits of argument. While it is true that the patient is rarely discharged from an absolute rest cure and given permission to return immediately to a life of activity, it is equally true that he is permitted to go through this most dangerous transitional period with no other supervision than that furnished by general directions given him by his physician upon his discharge. The writer is convinced that many of the relapses which he has seen might have been avoided had the patient before discharge had gradually increasing exercises prescribed and carried out under direct supervision until the sum-total of his exertions equaled or exceeded the probable exertion of the work which he was about to take up. However insistent may be the patient, it is not fair to him that he should be discharged until it has been demonstrated that he will stand an amount of physical exertion equal to any that his near future life may demand. The character of his subsequent life activities, as determined by his necessities or his abilities, must in turn determine the character and severity of what might be denominated the "work cure," which should always close the treatment of the patient to be discharged as arrested, apparently cured, or able to work, or as the Germans say, "Arbeits-faehig." Nor is it sufficient that the patient should have been able to carry out such a work cure for a period of a few days or a few weeks; he must have done enough, and have done it long enough to make it reasonably sure that the arrest is such. It is this safeguarding of the close of the treatment to which frequent reference has been made in this paper.

If the writer were to glean from his experience the most important causes of avoidable relapses of his own cases and of those of others who have come under his observation, he would specially mention, first, the cutting short of the period of treatment from whatever cause; second, the failure to close the rest cure with a work cure; third, the failure to give the patient instruction as

to the proper use of his work hours, but more particularly of his idle hours; fourth, and not least important, the patient's overconfidence in his result, as well as his misconception of the nature of his result, for which the loose use of the word "cure" is often responsible.

DISCUSSION ON PAPERS BY DR. WALSH AND DR. DUNN

Dr. James A. Miller, New York: I think we have before us in this most admirable paper perhaps one of the most pressing unsolved problems of tuberculosis today. I have nothing to add to nor to criticize in the admirable paper which Dr. Dunn has presented to us. I have, however, from the standpoint of the man in the city who sees the cases that come back from health resorts, a word or two to say, and the first is this, that the most frequent cause of relapse is the disease itself. That is the nature of tuberculosis, to relapse, and we have been too optimistic and given too wide-spread hope to the people at large of the curability of this disease. That has already been emphasized by Dr. Dunn. The second point which I would like to make is a criticism of the advice very often given by physicians in sanatoria—I am speaking particularly of those for the working classes—and that is, they give the impression that of all the things they should do when they return back home, the one thing they must not do is to go back to the working conditions from which they came. It seems to me that is bad advice, because, unless the sanatoria will provide proper training for their patients in some suitable occupation before they leave, the majority of them are better fitted to go back and take up either the same or similar work which they are accustomed to rather than something entirely new. If we take a stenographer, clerk, or bookkeeper and put them on outdoor work, they are not at all fitted to withstand the physical exertions consequent upon it, and I believe we are all agreed that physical overexertion out of doors does more harm than the indoor work, which only requires a portion of their day.

The other point I would like to suggest is this: It seems to me that the sanatoria are not taking sufficient responsibility in regard to their discharged cases. They do from time to time send a notice around asking that they be examined or fill out answers to certain questions, mostly for statistical purposes; but there is a hard-and-fast rule in the majority of sanatoria that no relapsed cases will ever be readmitted. It seems to me the time has come for them to assume more responsibility in regard to such cases, and I would like to make this suggestion: Would it not be feasible for cases discharged arrested or apparently cured to be required to report regularly every month or six weeks,

and later at longer intervals, to the representatives of the sanatoria in the particular locality to which they have moved, or may be the physician that originally sent them, and have those records sent in regularly to the sanatorium, and as an incentive to do that, offer the opportunity for such cases who do report regularly and are reported by the physicians as beginning to show evidences of relapse, to come back and finish their cure? In other words, it seems to me that the sanatoria, by making a hard-and-fast rule against readmitting discharged cases, are not fulfilling their mission, and the question naturally comes up: Is it not better to finish up a job partly begun, than it is to keep up this endless merry-go-round of taking up new cases, and doing nothing for those cases which will inevitably relapse?

Dr. C. H. Johnston, Grand Rapids: There is just one point I want to add to what Dr. Miller has said. Of course, but a small part of the total number coming from the sanatorium ever return, and I have said to our sanatorium superintendent time and again, "Send your patients back to the doctor who sent them to you." They don't do it. I have sent patients to half a dozen eastern sanatoria, and, as a rule, when they come back to Michigan, they never come to see me again, and they do not go to see anybody. I followed one man through three relapses in the last five years, and of the last one he died. That man went to see absolutely no physician at all from one relapse to another, until he got in a hopeless condition, and then he was sent back to the sanatorium. I think the patients at the sanatoria get the impression that the physician at home is of but little consequence in the cure, apart from the fact that they need observation, so when their disease is arrested they do not go back to their old physicians.

Dr. H. Holbrook Curtis, New York: I have but a word to say in regard to this question. It seems to me I am in the presence of a very optimistic body of men. The great question in regard to the treatment of patients who have been discharged from sanatoria depends more upon the state of the finances of the patient and the state of the financial condition of the sanatorium rather than any theoretical observations in regard to what they shall do. If we could teach our patients to eat libraries or if we could tax tombstones, I think we would be getting very much nearer to the truth and the solution of the problem in which we are interested. It struck me the other day in going past a large cemetery that there was a great deal of money wasted in mausoleums costing half a million dollars for the burial of men whose bones are of no more interest than an old skull buried in the catacombs. The thought occurred to me that this money might well be turned to profit in the cure of tuberculosis. I made a small estimate, which took me a few days, and I

found out that there were two hundred million dollars worth of tombs in the cities of Boston, New York, and Philadelphia alone. Five per cent. interest on that amount of money would net ten million dollars for the purpose of eradicating tuberculosis. I have no trouble in thinking of what to do with patients who are to be cured; but I find that there is no provision made in any sanatorium with which I am connected, or ever heard of, as to what the patient should do for himself after he left. It is my opinion that farms should be established and these farms should be supported by the State. I think the question of tuberculosis today is up to the State, and up to the government. In speaking sociologically on this question, I am not speaking absolutely on the point at issue; but, excepting one gentleman who spoke, I have not heard any discussion of the question at issue, and I sometimes think that a suggestion is better than a paper and that we ought to be allowed a little latitude, and I would like to see the whole trend of this convention's work tend toward the national and State care of consumptives during their treatment as well as during the stages of convalescence afterward.

Dr. Albert P. Francine, Philadelphia: May I say one word, not from the point of view of a man who has had any experience with patients at sanatoria, but one who sees them when they come back? One sends an early favorable case to a sanatorium, and at the end of five or six months the patient is discharged arrested. When such cases return their lesion in the process of cure is found distinctly increased in size. This statement is not made from a clinical standpoint only, but from the use of the *x*-ray. I have them *x*-rayed before they go, and examine them in the same way again when they come back after a period of treatment in the sanatorium. All during that time there has been a steady progress toward cure, but pathologically an increase in the extent of the lesion, which shows very plainly. Thus a cavity may develop, or an apex show evidence of a lesion which was not previously present, yet the cure has gone steadily on. Thus, while they have been developing resistance to the toxemia of the disease, there is a slow advance in the morbid process itself. In other words, sanatorium treatment develops resistance to toxemia and clinical symptoms, but many of the cases which are discharged as arrested are not, pathologically speaking, arrested, and this may account for many of the relapses.

Dr. Woods Hutchinson, New York: I think Dr. Dunn's paper is one that has sounded one of the most vital notes on this subject, and is a word of warning that we would do well to remember. We have been too optimistic altogether in regard to our belief as to the curability of consumption. We have said, and said seriously, that 75 per cent. could be cured, for-

getting the peculiar fact that the consumptive is not a depressed individual, but quite the opposite. They go up easily, but come down easily. They are of that type mentally, as well as physically, and we have been allowing them to think that because they have gained 15 pounds in weight in three months' time, therefore the progress of the cure is certain.

It so happens that I have visited many sanatoria and health climates in different parts of the country, and have practised in several of them, and the most painful thing that impressed itself upon my attention was how large a percentage of the inmates at these health resorts were graduates of one or more other resorts before they came. Consumption, in fact, is so easily cured that it can be cured four or five times in the same individual. I dislike to use such a painfully personal argument, but I think a very striking illustration is furnished by the condition of our profession in this respect. We are all acquainted, of course, with anywhere from 50 to 100 members of our profession who have developed the disease and have secured its arrest and gone to one of these health resorts to live. It would not be any exaggeration to say that 80 per cent. of them still have the disease, and that they have to exercise constant care, and be ever on the lookout against reinfection. If they are in such condition, what is going to be true of the average layman, who thinks he is cured after three or four months' residence in a sanatorium?

It merely means that we have got to make our work more thorough and do better work for the care of the consumptive after he goes home. It is not only true that long hours of labor are dangerous and injurious to consumptives: they are dangerous and injurious to the average individual. Habits of irrational and ill-regulated industry are as dangerous as any vice that attacks the community, and we ought to regulate our lives with that idea in mind.

The other conclusion is that we ought to pay more attention to the advanced cases. Every time we succeed in keeping an advanced actively infectious case in a sanatorium for a year we are doing practically twice as much good as we would by keeping an early "closed" case in a sanatorium for a year. We prevent the infection of two new cases instead of merely half curing one. Instead of concentrating our attention upon the incipient cases, we should pay more attention to the arrested cases and the advanced cases; otherwise we are simply playing a harmless parlor game of tag with the disease, and will not make any approach to its extermination short of half a century.

Dr. Charles L. Minor, Asheville: I think we all realize that finance is at the bottom of most things, and that finances are at the bottom of this question we are now discussing, but financial questions that the doctor need not discuss. Therefore, the points Dr. Dunn brought up are

really the essential ones. The cure of tuberculosis is a sociological question much more than a medical one, and as we seem to be sweeping forward to a period of socialism, I can see a time when Grandfather Sam is going to take care of all the tuberculous, and run the finances of all of us, and I have no doubt that it will have a certain benefit for our lower classes, although politically, doubtless, I will regret the approach of such a time. There was one point referred to by Dr. Dunn on which I would like to lay particular stress, because it is so important, and that is, the overdoing of the rest cure. In the beginning the rest cure is essential, but what Dr. Dunn said is certainly true—you have got to work your patient up by degrees, until when he leaves the resort he is strong enough to do more than he will have to do when he gets home. Too many patients are kept at rest and then sent home unprepared by gradual exercise to do anything at all.

Dr. Myer Solis-Cohen, Philadelphia: Not only should the patient be instructed what he is to do, but the principles underlying those instructions should be explained to him. The physician should take the patient into his confidence and explain to him the reasons for everything, that the patient may know why he is doing all the various things, and realize that he has to do them all his life. Emphasis should be laid on the fact that not only is right living a specific for tuberculosis, but that it is something to be carried on by everybody; that in tuberculosis we simply accentuate the conditions of life that are necessary to keep everybody well; that while the tuberculous patient most of all needs these conditions to get well, everybody requires them, whether sick or well, whether they have tuberculosis or not. In this way the patient, after leaving the sanatorium, will continue throughout life observing the ordinary hygienic rules that should be observed by everybody, sick or well.

But there is a further difficulty. You can instruct a person and tell him what to do, and you may think that the person has understood perfectly all you have told him, when, as a matter of fact, he may not. I had that experience in my tuberculosis class at the University of Pennsylvania. Week after week I would tell the same patients the same thing, explaining about fresh air, food, and hygiene, giving the reasons for everything. After eight or nine times, when I got tired of saying the same thing over and over again, and noticed that the patients were not particularly responsive, I adopted the expedient of having the patients themselves give the talks, asking one patient to give a talk on fresh air, another to speak on the care of eating utensils, and so forth. The patients probably knew the things that had been told them, but were unable to express themselves, not having the information definitely fixed in their own minds. So I gradually trained all the patients to lecture on tuber-

culosis, the patients not only learning to instruct new patients who came into the class, but going out and telling their friends and neighbors how to keep well and avoid contracting consumption, thus spreading throughout the city the knowledge of proper living.

Dr. C. O. Probst, Columbus: Some of our State institutions have a system to follow up the people who leave the institution. It seems to me it might well pay a State sanatorium to have a special agent to visit the discharged patients from time to time to see how they are getting along, and to see whether or not they are carrying out the instructions received at the sanatorium. We send all our nurses into the homes of the patients in our city to see whether they are carrying out instructions. The discussion here today has been so pessimistic in regard to the incurability of tuberculosis that I should not be surprised much to see the morning papers come out saying that tuberculosis is incurable. Now, I am sure we do not believe that, and I think a word ought to be said on the other side of the question. I think every one here knows of cases of tuberculosis that certainly we can say are cured. As to the use of the sanatorium for advanced cases, as recommended by Dr. Hutchinson, it seems to me we ought to make a distinction between the sanatorium and the hospital. I believe in the sanatorium for the cure of tuberculosis, and the hospital near at home for the care of advanced cases.

Dr. L. Rosenberg, Bedford Station, N. Y.: I want to take occasion to emphasize something that Dr. Dunn brought out, among the many other good things he said, and that is, the misuse of the word "cure." There are gentlemen here who know how much I have discussed the question of the meaning of that word on the part of the various sanatoria throughout the country. The cases whom we discharge with disease arrested or simply improved do far better in the end than the cases that go out with a chip on their shoulder and say, "I am a cured man." It is human nature and perfectly natural for a man, when told by a physician that he is cured, to resume his former methods of living. I have always contended that the expression cured or apparently cured should be used with extreme caution. I make it a rule to tell them that if they are once tuberculous, they are always tuberculous. It is impossible to outline a mode of living that will safeguard a patient from relapse if he has not sufficient strength of character to follow it out. But I do wish to correct a misapprehension that may arise from Dr. Miller's remarks. I happen to be connected with a large sanatorium with a capacity of 180 beds, and it is the rule with us to receive back all patients who relapse provided their conduct on their first stay justifies it. In

other words, we tell them that they may look upon the sanatorium as a haven of retreat should misfortune again overtake them, and I think this ought to be the humane stand of every sanatorium. We get the very poor who have no other place to go to but public institutions, and they ought to be received back again even if, as Dr. Hutchinson has facetiously said, they are going to be cured five times over.

Dr. J. Ritter, Chicago: It has been my experience and observation that where the husband is sick and the wife has to make the living while he is at the sanatorium, when the husband comes back, he is usually too lazy to go back to work. Many of them are good while they are at a sanatorium under the care of a physician; but my impression is that we are creating too large a class of chronic resters, and I think we ought to get them to a certain point, and then insist upon their going back to work.

EARLY CHANGES IN THE LARYNX IN PULMONARY TUBERCULOSIS

By Charles L. Minor, M.D.

Asheville, N. C.

There is no more encouraging fact in the development of modern medicine than the interest that is being taken in the early diagnosis and in the rational treatment of pulmonary tuberculosis, and it has already done much to lessen the sum-total of human misery. However, it will not do for our profession to be satisfied with what has so far been accomplished, for satisfaction with one's own achievements rings the knell of all further progress; rather, physicians should keep their minds open to discern where our present practice is imperfect, and be ready to correct these flaws as soon as they are discovered.

An important defect in the profession's attitude toward the early diagnosis of tuberculosis is the fact that few men in their examination of such cases pay any attention to the condition of the larynx or are capable themselves of making the necessary examination to determine the condition of this organ.

I do not hesitate here to say that no examination of a tuberculous case can be called satisfactory or thorough in which such a laryngeal examination has not been made, and that the value of this examination to the patient and to the doctor in charge will be very greatly increased if the latter has taken time to master the technic of laryngoscopy so that he can see for himself, and not through another's eyes, however expert, the condition of things, for no other man's report of what he has seen or found can begin to equal in its effect on the mind the results of our own observations. Therefore, it is always greatly to be regretted when the physician has to depend upon the report of another man as to existing conditions in his patient, and while, in view of the enormous growth of modern medicine, this is necessary in many cases, notably as regards laboratory work, which no busy practitioner, however well trained, has time to do for himself, laryngoscopy is so easily learned, and so easy and quick of

application when once mastered, that no physician who wishes to be thorough need say that he cannot master it or that he has not time to apply it.

Further, a reading of the literature of the subject shows that the laryngeal conditions usually recognized and spoken of are not those early and curable changes which can only be discovered by the use of the laryngoscope, but, rather, relatively advanced alterations, such as turbaned epiglottes, pear-shaped arytenoids, extensive ulcerations of cords, or commissure, or epiglottis, etc., which produce clear symptoms; which explains why the profession looks upon laryngeal tuberculosis as a "noli me tangere," and considers a diagnosis of such trouble as tantamount to a death sentence. If the doctor would take the trouble to master laryngeal technic, not necessarily so thoroughly as to prepare himself to do endolaryngeal operations, etc., but so as to enable him easily and thoroughly to look at the larynges of his patients and familiarize himself with the early changes which antedate the conditions I have noted, he would find, I believe, many tuberculous throats he had not suspected, and that a much larger percentage of such cases can be cured than he had hitherto supposed. While I would not, of course, wish to be understood as saying that laryngoscopy is not a matter of skill, I am ready to assert that it is not an extremely difficult matter to learn to see the larynx clearly, and after a man has learnt to see clearly, he needs only brains and opportunity to learn to diagnose these conditions early.

If it becomes an accepted view that a laryngeal examination is a routine and essential part in every physical examination, it will not be long before the profession learns that the prognosis in laryngeal tuberculosis is not what they have thought it to be, and it is to encourage such an attitude that I have come before you today.

Taking up first the symptoms of early laryngeal tuberculosis, we find them to be limited in number and not as valuable as the signs. The earliest is usually a mere weakening of the voice, which may exist for a long time before any hoarseness appears, and here let me note that while hoarseness is a prominent and often an early symptom, it is by no means always present, and that the case can advance considerably before it appears, while sometimes it is surprising how well the voice is retained despite extensive trouble. Next to a weak voice I would note a sense of dryness in the throat, with which is soon associated an insufferable localized tickling, scratching, or pricking, as though a hair had been swallowed. In my experience pain on swallowing is not usually an early symptom, though a consciousness of the larynx at such times, as if a lump were in the throat, comes soon.

However, the subjective symptoms are relatively unimportant compared

to the great importance of the objective signs, and it is on these that I wish to dwell.

While it has been very generally taught that a pallor of the mucous membrane is the earliest change in this disease, I am glad to see that recently several voices have been raised against this view, notably Lockard's in his recent excellent book.

Personally, I have not found this often an early sign, and believe that catarrh with hyperemia is usually the first manifestation of beginning trouble, though, of course, this is not in itself diagnostic. Those who treat pulmonary tuberculosis have, I believe, an earlier opportunity of seeing the beginning lesions in the larynx than the laryngologist, save in a health resort, for when a patient comes to a specialist in a city, it is usually for pronounced and troublesome symptoms, whereas, since pulmonary trouble usually greatly antedates laryngeal lesions, by systematically watching the throats of his pulmonary patients the doctor has the chance very often to see the very beginnings of the trouble.

It is only when the catarrh I have referred to begins to localize itself and becomes unilateral that it gets really suspicious, for it must be recalled that every pulmonary patient is unduly subject to ordinary laryngeal catarrh. A patchy catarrh, localized, however, to one cord, or to one arytenoid, is highly suspicious, though still not positively diagnostic, but such a localized condition occurring in a patient in whose lungs we know there is a tuberculous deposit would come very near to certainty. I might here also note that the trouble is very frequently on the same side as the lesion in the lung.

Next to this I would note as highly significant a grayish wrinkling of the posterior commissure. This I believe to be the commonest early finding, but since it can be simulated by a chronic catarrh, such as is often seen in public speakers, it will not do to base a diagnosis on this alone. The earliest change which has real diagnostic significance is, in my experience, a table-like elevation of the mucous membrane in the posterior commissure. This generally occupies the center of the commissure, in which case it shows a vertical furrow or depression down its center, dividing it into two symmetric halves; but it is frequently unsymmetric and situated to one or the other side of the center. The color is generally grayish-pink, though at times it may be congested.

Such an elevation in this location I believe to be pathognomonic, and in this view I have the support of so able an authority as Schnitzler. Such elevations tend to break down into shallow ulcers, though they may remain intact for a long time, but when ulceration does occur, their tendency to fill

up with exuberant pointed granulations often conceals their nature and causes them to pass for tuberculomata.

Such infiltrations can, under suitable treatment, slowly but entirely disappear.

Next to the posterior commissure as a site of early changes is the processus vocalis, the posterior insertion of one cord, or the body of the cord itself. In the first case the cord at its posterior end is red, thickened, and beefy, and a small white ulcer tends finally to form and takes on a triangular shape, its apex forward at the processus, its base posteriorly at the commissure. Where the cord itself is involved, it is at first congested and slightly thickened and finally becomes fleshy and spindle-shaped, a very typical condition in this disease, while if it begins to ulcerate, the area where the ulcer is to form looks pale and thickened.

Ulcers of the cord, instead of being localized in one spot, may be scattered along the edge, producing the characteristic nibbled-out appearance. Tuberculous ulcers tend to be shallow, of indefinite outline, to run together and to be multiple, and, if on the cord, are usually in its posterior one-third. A longitudinal ulcer along the free edge of the cord, and giving the impression that the cord is double or split, is a common but not an early change.

Quite an early change is the thickening and yellowing of the false cords or ventricular bands which partially or totally hide the underlying cord and is very effective in producing hoarseness. Its upper surface often shows erosions or shallow, grayish-yellow ulcers, but not usually early in the course of the case.

Very early in the disease we find some involvement of the arytenoid region—either localized congestions or anteroposterior thickenings. In my experience the cartilage of Wrisberg shows reddening sooner than that of Santorini. Another very typical change in the posterior commissure is the formation of pointed or round tuberculomata, which, though they can resemble soft granulations, are surprisingly hard and firm to the touch, and may persist unaltered for years. Thickening of the aryepiglottic folds is a more advanced change, but when present, is pathognomonic. Likewise, changes in the epiglottis do not occur early, though sometimes they can be foreshadowed for a long time as areas of slight thickening and reddening of its edge or posterior surface.

I might also mention as an early change, though a rare one, the protrusion of a small teat of red granulation beneath the anterior commissure; when seen, its diagnostic value is great.

Such are, I believe, the earliest changes to be found in the larynx in tuberculosis, and if the physician will himself examine every case of pulmonary

tuberculosis as to the presence of laryngeal changes, he will be surprised to find how large a number show some alteration from the normal, the more conservative estimates placing this at 30 per cent. of all cases.

A few words before closing on the therapeutics of this stage. First and foremost, I would place absolute rest to the voice, though there is nothing so difficult as to induce your patient to stop talking absolutely and to use only writing as a means of communication. Let me here note that even whispering should not be allowed, as it is by no means compatible with rest of the larynx. Next I would place the avoidance of all irritants, notably smoke, dust, and furnace-dried air, smoking being, I believe, absolutely harmful in these cases. Thirdly, cleanliness, which I attend to by having the patient spray his larynx, and not his mouth, with an alkaline solution, using a proper long-stemmed atomizer with a tip at right angles and pointing downward. Fourthly, astringents. Where there is much congestion or soreness, I find an astringent spray of alumnol, 2 per cent., very useful, while if the throat is not too congested, one of the common mentholated oily sprays will be comforting. I have been able to teach my patients to spray their own throats very satisfactorily, and the relief to the symptoms and improvement in signs is marked.

However, the drug which I have come to rely on more than any other to cure these cases is iodoform—not the ordinary amorphous form, but the fine crystalline form, which is not usually found in our drug-stores. This I have the patient insufflate morning and night from a proper apparatus, which, like the atomizer, must be long enough to reach over the top of the larynx, and must have a tip which will blow the powder directly down into the organ.

It is surprising what excellent results can be gotten in non-ulcerated cases by the systematic and faithful use of this measure, and how infiltrations can be absorbed or made inactive.

Since early cases rarely have dysphagia, the use of local anesthetics is not usually called for; where needed, I have usually found insufflations of orthoform before meals very satisfactory, or where this is not sufficient, solutions of acetate of morphin, 5 grains to the ounce, taking care not to use it too freely.

Let me, before closing, warn the physician, who has not had careful training in making endolaryngeal applications with the cotton-tipped laryngeal sound, against resorting to them in the treatment of ulcerations. Of course, for infiltration they are of no use and would only do harm. Lactic acid so applied in moderately advanced cases is a very valuable remedy, and I have seen many ulcers heal under its use, but unless one is very familiar

with the use of the laryngeal sound, it is easy to do great harm with it, and it should, therefore, only be used by the expert.

Finally, I am sure that if doctors will take the time and trouble thus to examine the throats of their tuberculous patients, they will find its results fully justify the time and effort needed, and that, through discovering the lesions early and treating them while yet they may be cured, they will come to take a less hopeless view of the prognosis of these cases than has hitherto been the case.

GASTRIC DISTURBANCES IN PULMONARY TUBERCULOSIS

By H. R. M. Landis, M.D.

Philadelphia

The successful treatment of pulmonary tuberculosis largely depends on three factors: fresh air, rest, and diet, the importance of the last named being dependent on a capable digestive apparatus. Opinion may differ as to which is the most important factor, but it is certainly true that recoveries do occur when the first two conditions are but imperfectly carried out, while the inability of the patient to obtain proper nourishment, or his inability to take or to assimilate food, almost invariably spells failure.

As a rule, gastric disturbances occurring in the course of tuberculosis are in no way due to changes in the stomach peculiar to tuberculosis itself, the changes commonly found being such as might occur in any chronic wasting disease. Furthermore, it is a well-recognized fact that these gastric disturbances may constitute a very prominent place in the symptomatology without there being any adequate pathological lesion to explain their occurrence.

The pathological changes found in the stomach in 73 fatal cases at the Phipps Institute were as follows:

Gatroptosis	33
Gatroptosis and enteroptosis	9
Gastritis	29
Congestion of gastric mucosa	16
Stomach undersized	5
Pyloric contraction	1
Superficial ulceration (3)	1
Stomach adherent to spleen	1

None of the above findings are in any way peculiar to tuberculosis. The only lesion of the stomach which can be directly attributed to tuberculosis is the tuberculous ulcer. Primary tuberculous disease of the stomach is unknown, and even secondary invasion of the stomach is not frequent. The comparative rarity of tuberculosis of the stomach is ascribed to the fact that there is very little lymphoid tissue in the organ, and what little there is, is deeply seated.

Furthermore, the tubercle bacilli are in contact with the gastric mucosa for but a comparatively short time. The inhibitory action of the gastric juice is a doubtful factor. It certainly has little or no influence on these organisms, as it has been conclusively shown that tubercle bacilli, when subjected to gastric juice, either in vitro or in vivo, retain their virulence and power of producing disease. Most observers are agreed that for a tuberculous ulcer to develop there must be a preëxisting lesion of the gastric mucosa which enables the tubercle bacillus to gain a foothold. Thus in a case seen at the Philadelphia Hospital there was a hernia of the gastric mucosa measuring 2 by $1\frac{1}{2}$ cm., and on this protruding mucous membrane were a few flattened, yellowish nodules resembling tubercles. This may possibly have represented the initial stage of what would later have become a tuberculous ulcer.

Ordinary ulceration of the stomach occurs with about the same frequency in tuberculosis as in other diseased conditions, namely, in about 2 per cent. of cases. In 480 autopsies at the Phipps Institute non-tuberculous ulceration has been met with in 6 instances. In 113 consecutive autopsies at the Philadelphia Hospital ulceration of the stomach was noted in 7 instances, and in 5 more there was an ulcer in either the esophagus (3) or in the duodenum (2). The incidence in the latter series is unusually high, not only for the stomach, but also for the esophagus; ulcers in the esophagus are rare under any circumstances.

Of the 10 ulcers in the series from the Philadelphia Hospital these,—one of the stomach and the two of the esophagus,—while not examined histologically, had every indication, from the gross examination, of being tuberculous in character. The following is the gross description of these ulcers:

Case I (*Stomach*).—On the lesser curvature, about midway between the cardia and pylorus, are two small ulcers, the largest measuring about 8 mm. in diameter. The edges are elevated and firm. The ulcers are shallow, with pale bases, studded with small gray granules, and on the peritoneal surface beneath the ulcers are small gray tubercles.

Case II (*Esophagus*).—Six cm. above the cardiac end of the stomach is a constriction corresponding to a fibrous ulcer on the posterior wall; section of the constricted area corresponds to an adherent lymph-node.

Case III (*Esophagus*).—Just above the cardiac orifice is an ulcer 1 cm. in diameter, perforating the mucosa and forming between the muscularis a small culdesac. The wall of the esophagus is the seat of infiltration and erosion, leaving a rough, granular, yellowish-white surface. The process extends throughout the entire circumference of the esophagus, 1 cm. above and 2 cm. below the ulcer.

Gastric disturbances play almost as prominent a part in the symptomatology of tuberculosis as the phenomena which arise by reason of the pulmonary

lesions. Furthermore, from the standpoint of treatment they are possibly of more importance, for if they cannot be corrected, our chances of success in arresting the pulmonary lesions are very slight. It is rare, indeed, that the consumptive, some time during the course of his disease, escapes disturbances of the gastric functions, disturbances that range all the way from simple anorexia to severe vomiting attacks. While of frequent occurrence in the terminal stages of tuberculosis, gastric symptoms may appear at any time during the course of the disease. Indeed, a not uncommon mode of onset is that which manifests itself by symptoms that are entirely referable to the stomach, such as anorexia, gastric irritability, or acid eructations and distention. Unless this is kept in mind, the unwary are deceived as to the patient's true condition and much needless time is lost in endeavoring to correct a fault which has its actual seat in the lungs.

Taking all stages of the disease into consideration, gastric disturbances are met with in about one-half of the cases. An analysis of 3007 cases in the Phipps Institute showed that 1587 (53.30 per cent.) presented symptoms referable to the stomach. Although pathological changes are of frequent occurrence in the stomach of those dying from tuberculosis, it does not always follow that the cases showing such changes have had digestive disturbances during life. It too often happens that serious gastric lesions are found at the autopsy table which during life gave no evidence of their presence. Of the six gastric ulcers which have occurred at the Phipps Institute and the seven collected at the Philadelphia Hospital, not one was even suspected during life. On the other hand, the most distressing symptoms may have been present during life, and yet the autopsy fails to give any explanation as to the cause.

These discrepancies are well illustrated in the 73 fatal cases already mentioned. A comparison was made of the clinical symptoms and the autopsy findings, with the following results: Anorexia, sometimes amounting to a loathing for food, was present at some time during the stay in the hospital in 53. Vomiting occurred in 35; in 9 of these there was also marked nausea, and in 11 the vomiting was preceded by severe paroxysms of coughing. Epigastric pain after taking food was noted in 14; and in 26 there was epigastric tenderness or pain irrespective of the taking of food, due possibly to the dragging downward of a ptosed stomach. Distention and a sense of fullness in the region of the stomach after taking food were noted in 16.

In 10 cases there were marked symptoms of gastric trouble (nausea, vomiting, eructations, distention) without any demonstrable lesion.

In 10 with evidences of gastritis there were no symptoms during life, and 12 having various degrees of ptosis were also free from symptoms.

One case in which the stomach was adherent to the spleen and the one with three gastric ulcers presented no symptoms.

Nausea, vomiting, or distention after taking food was present in 15 having well-marked gastroptosis. In 11 showing either gastritis or marked congestion of the gastric mucosa, nausea, vomiting, or eructations were noted.

The explanation in those cases suffering from marked gastric symptoms without a demonstrable pathological lesion is probably to be found in alterations in the gastric juice. Sufficient work has been done on the composition of the gastric juice in tuberculosis to show that alterations in the functional activity of the stomach, broadly speaking, run a course nearly parallel with the progress of the pulmonary lesions. Thus in the early stages of the disease there is little change to be noted. As the pulmonary process advances, however, there is an increasing number in which the gastric juice becomes deficient, either in quantity or quality, and in the terminal stages these changes become very frequent. Brieger, for example, found but 16 per cent. of severe cases with normal gastric juice. It also has been suggested that the alteration in the gastric juice, in cases without change in the gastric mucosa, is due to neurotic influences or to the hectic fever. The latter point has been investigated by Hildebrand and Brieger. These observers, however, obtained widely divergent results, the former finding that in the presence of fever there was an absence of hydrochloric acid, while the latter failed to find that the fever exerted any such influence.

There is a comparatively common type of digestive disturbance that seems to be the result of functional rather than organic trouble. While the dangers of forced feeding have, I think, been overestimated, it is unquestionably true that in not a few instances this method does give rise to trouble, especially if improperly applied. It is now well recognized that any disease characterized by poor nutrition requires a generous diet, and such a diet almost always consists of one rich in fats, such as milk, cream, eggs, olive oil, etc. It has been pointed out by Edsall, however, that there are certain individuals, phthisical as well as others, in whom there exists an intolerance for fats; some cannot take even a normal amount of fat, while in others trouble arises only when fat in excessive amounts is given.

Until Edsall's paper was published I was at a loss to explain why it was that in certain individuals, under forced feeding, bilious attacks would occasionally occur, although I knew that purgation and the temporary reduction of the diet speedily dispelled this condition.

The clinical picture presented by fat intolerance is fairly distinct. Such a patient presents a sallow skin, the breath is foul, the tongue is heavily coated,

there is a distaste for food, and there may be nausea, with or without vomiting. The bowels may be constipated or there may be diarrhea. In addition, if the patient has been afebrile, there may be an abrupt rise in the temperature and some increase in the pulmonary symptoms. In such a case the symptoms disappear in a few days if a saline is used and the fatty foods are reduced. For a time the whites of eggs only and skimmed milk should be used. Later the fatty elements may be gradually increased, the increase being determined by the condition of the tongue and the appetite.

Most of the instances of fat intolerance that I have seen have occurred in patients just entering the White Haven Sanatorium. Questioned as to their diet before admission, they have, as a rule, stated that they had been eating three meals a day, and in addition all the milk and eggs they were able to take. This, I think, is the real source of trouble in most cases. No matter what form of diet we use, the quantity of food and the time for taking it should be specifically stated. Furthermore, forced feeding should never be carried farther than is necessary to obtain a satisfactory gain in weight. In other words, the needs of each individual patient should be carefully studied.

DISCUSSION ON DR. LANDIS' PAPER

Dr. Herbert M. King, Loomis, N. Y.: In discussing the above paper Dr. King presented the following report of observations:

Total, 26 cases. Normal total acidity, 40–60 acid per cent.

Test-meals:

3 breakfasts, consisting of 1 shredded wheat biscuit
2 glasses of water (forty-five minutes).

One test—four hours after full meal.
One test—fasting in morning.

INCIPIENT—8 *cases.*

Acidity:	5 inactive	3 normal total acidity	60	per cent.
		2 subnormal total acidity	40	per cent.
	3 active	3 increased total acidity	100	per cent.
Motility:	5 inactive	4 normal	80	per cent.
		1 lessened (gastroptosis)	20	per cent.
	3 active	2 increased	$66\frac{2}{3}$	per cent.
		1 lessened	$33\frac{1}{3}$	per cent.

MODERATELY ADVANCED—12 *cases.*

Acidity:	9 inactive	4 normal	$44\frac{4}{9}$	per cent.
		4 decreased (1 achylia)	$44\frac{4}{9}$	per cent.
		1 increased	$11\frac{1}{9}$	per cent.
	3 active	3 subnormal	100	per cent.
Motility:	9 inactive	4 normal	$44\frac{4}{9}$	per cent.
		4 decreased	$44\frac{4}{9}$	per cent.
		1 increased	$11\frac{1}{9}$	per cent.
	3 active	1 normal	$33\frac{1}{3}$	per cent.
		2 decreased	$66\frac{2}{3}$	per cent.

FAR ADVANCED—6 *cases.*

Acidity:
- 3 inactive
  - 1 normal..... 33⅓ per cent.
  - 2 decreased..... 66⅔ per cent.
- 3 active
  - 2 normal..... 66⅔ per cent.
  - 1 decreased..... 33⅓ per cent.

Motility:
- 3 inactive
  - 2 normal..... 66⅔ per cent.
  - 1 slow..... 33⅓ per cent.
- 3 active
  - 1 normal..... 33⅓ per cent.
  - 2 slow (1 gastroptosis)..... 66⅔ per cent.

Résumé.—In *active incipient* cases the total acidity and motility are increased. In the *inactive incipient* stage there is shown no uniform disturbance in these two factors, only such as is found in non-tuberculous cases.

In *moderate* and *far-advanced cases—active and inactive*—the tendency inclines to a lowered total acidity and motility, especially in the *active* stage.

Gastroptosis (marked) occurred in two cases.

Achylia gastrica occurred in one case.

SOME RESULTS OF SANATORIUM TREATMENT OF PULMONARY TUBERCULOSIS IN CHILDREN

By Henry Skinner Goodall, M.D.
Lake Kushaqua, New York

(Read by Title)

The question has been occasionally put to me whether or not it is worth while to treat pulmonary tuberculosis in children at a sanatorium. I have been told by at least one prominent antituberculosis worker that it was not worth while, as the late results were bad, even if one was fortunate enough to secure good immediate results. Because of such inquiries and statements it has seemed to me wise to make the following report of our results at Stony Wold Sanatorium.

The number of children discharged during our first six years of operation is 120. One of them was a boy thirteen years old on admission, a moderately advanced Turban II case, who was discharged with disease arrested. One case was non-tubercular, one remained with us only two days, one was a laryngeal case, with only very slight demonstrable pulmonary disease, and five had some enlargement of the lymphatic glands, without suppuration and without positive signs of involvement of the lungs. One of the glandular cases was discharged apparently perfectly well, and the others were much improved. The laryngeal case had considerable ulceration of the epiglottis, but was discharged in good condition, with the ulcerations healed. He has, however, since died.

The remaining 111 children comprise:

33	boys	between	the	ages	of	6	and	12,	inclusive.
35	girls	"	"	"	"	6	"	12	"
43	"	"	"	"	"	13	"	16	"

The classification of the National Association for the Study and Prevention of Tuberculosis was followed, the terms used being interpreted according to the definitions approved by the American Sanatorium Association. The presence of râles of any kind was considered incompatible with apparent cure, except in case of transient fine dry crackles at the base of the axilla, and those râles

also were considered incompatible with apparent cure if the region where they were heard had shown evidence of pulmonary disease during residence.

It will be noticed that the presence or absence of tubercle bacilli in the sputum has been omitted from the table. Almost all the children either raised no sputum or else had negative sputum. No special effort was made in any number of cases to obtain sputum, either by washing the stomach in the morning, by swabbing the throat after cough, or otherwise. The diagnosis in the children was based chiefly on the history and physical signs, supported by the tuberculin test in cases where there appeared to be any doubt of the diagnosis.

	Turban		Age in Years	Number of Cases	Average Residence in Weeks	Per Cent. Apparently Cured	Per Cent. Arrested	Per Cent. Improved	Per Cent. Unimproved
Incipient.....	I	Boys	6–12	20	47.5	70.0	30.0	00.0	00.0
		Girls	6–12	20	51.6	85.0	5.0	10.0	00.0
		Girls	13–16	21	41.3	61.9	23.8	10.0	4.3
		Adults		49	27.1	65.3	20.4	14.3	00.0
Moderately Advanced..	I	Boys	6–12	4	55.7	50.0	25.0	25.0	00.0
		Girls	6–12	4	46.9	00.0	75.0	25.0	00.0
		Girls	13–16	2	40.8	50.0	50.0	00.0	00.0
		Adults		18	28.9	38.9	38.9	16.7	5.5
	II	Boys	6–12	8	57.5	12.5	50.0	25.0	12.5
		Girls	6–12	9	51.3	33.3	33.3	22.2	11.1
		Girls	13–16	13	33.7	23.0	30.8	38.5	7.7
		Adults		98	42.5	8.2	44.9	36.7	10.2
	III	Boys	6–12	1	31.7	00.0	100.0	00.0	00.0
		Girls	6–12	1	81.5	00.0	00.0	100.0	00.0
		Girls	13–16	2	40.7	00.0	00.0	50.0	50.0
		Adults		24	28.8	00.0	45.8	41.7	12.5
Far Advanced....	II	Boys	6–12	0	00.0	00.0	00.0	00.0	00.0
		Girls	6–12	0	00.0	00.0	00.0	00.0	00.0
		Girls	13–16	1	27.7	00.0	00.0	00.0	100.0
		Adults		1	31.0	00.0	00.0	100.0	00.0
	III	Boys	6–12	0	00.0	00.0	00.0	00.0	00.0
		Girls	6–12	1	60.7	00.0	00.0	100.0	00.0
		Girls	13–16	4	59.0	00.0	25.0	75.0	00.0
		Adults		45	24.8	00.0	6.7	64.4	28.9
Totals of All Classes..		Boys	6–12	33	49.0	51.5	36.4	9.1	3.0
		Girls	6–12	35	49.3	57.1	20.0	20.0	3.0
		Girls	13–16	43	40.7	39.5	25.6	25.6	9.3
		Adults		235	33.1	20.3	31.5	36.7	11.5

The table on page 199 gives the condition on admission and discharge, and the average residence of the various classes. For purposes of comparison, the results obtained in 235 adults, seventeen years of age and upwards, discharged in 1908 and 1909, have been included in the table.

It will be observed that the number of patients in all classes of children, except the incipient and moderately advanced Turban II, is much too small to give averages of value. We will, therefore, limit our comparisons to these two classes, which embrace the great majority of the children. Comparing the classes in the different age groups with each other and with the same classes among the adults, we find that the little girls—six to twelve years of age—give better results than any of the other groups in both the incipient and the moderately advanced Turban II classes. Among the incipient cases, the boys come second, the adults third, and the girls from thirteen to sixteen last. These differences may be modified somewhat by the fact that the average residence of the little girls is decidedly longer than that of either of the other groups; but this will certainly not account for all the difference, and we must conclude that by a certain margin the six- to twelve-year-old girls show the best results. The boys show a percentage of good results above the girls of thirteen to sixteen years of age greater than could be accounted for by the few weeks' difference in residence, and we must admit that they come next to the little girls. The girls from thirteen to sixteen give poorer results than either of the other age groups of children, and worse than those obtained among the adults, and this in spite of the fact that the average residence of the thirteen- to sixteen-year-old girls is much greater than that of the adults.

Among the moderately advanced Turban II cases, making due allowance for differing average of residence, the little girls—six to twelve years old—again give the best results; the girls from thirteen to sixteen years come next; the boys from six to twelve years third; and the adults last. Taking all classes together, the order is little girls, little boys, girls thirteen to sixteen years old, and adults.

The reasons for these differences may be sought for in the presence or absence of the menstrual function, the habits of activity of the various groups, the condition of the system apart from the lungs, and the presence or absence of gastro-intestinal and other complications.

The establishment of menstruation is a period of unbalance in physiological conditions, and frequently involves considerable strain upon the vital forces. For this reason we would expect the girls from thirteen to sixteen years of age, who are passing through this transition or have recently done so, to be less able to battle with a serious disease than the boys or the little girls. The

natural inclination of the boys to take more violent exercise than the girls is a handicap to them, and shows its effects more in the moderately advanced than in the incipient cases. We have very little trouble in keeping the girls of all ages reasonably quiet, but the boys will be boys whenever they can get out of sight of the doctors and nurses—much to their detriment.

The functional condition of the various organs, aside from the lungs, has been much better, on the average, among the little girls and the boys, than among either of the other groups, and better among the thirteen- to sixteen-year-old girls than among the adults. There are fewer and less severe gastro-intestinal disorders, fewer cases of appendicitis, of tubo-ovarian disease, dysmenorrhea, etc., of renal disturbance, and of neurasthenia. There is usually no worry over family or financial matters to hold the little ones back. There have been less tubercular complications among the little girls and boys and among the thirteen- to sixteen-year-old girls, than among the adults; less hemorrhages, less mixed infections, less pneumonias, pleurisies, and laryngeal involvements. There have been more glandular complications, but in only one case did the glands make serious trouble or go on to suppuration. The cases of children with complicating bone disease have been very few, and most of them have done well.

The occurrence of hemorrhages in the different groups has been of especial interest to me. Among the 33 boys, only two had hemorrhages, either before or during residence. Among the 35 little girls six to twelve years old, only five had hemorrhages before or during residence, and three of these five girls began to menstruate within a short time (two or three months) after the hemorrhage. Of 43 girls thirteen to sixteen years old, 15 had hemorrhages before or during residence, and all of these but three had established menstruation before the hemorrhage, or did establish it soon after. Two of these three were old enough and sufficiently developed so that they would undoubtedly have been menstruating but for the severity of the pulmonary disease.

The later results can be stated very briefly. So far as we have been able to trace the three age groups of children, all who were discharged as apparently cured or arrested are at present as well as, or better than, they were on discharge. Making a liberal allowance for relapses, etc., among those not traced, we may still feel sure that the final results are as good as, or better than, those among our adult patients. Many of those who have been traced and found to be still apparently well have established menstruation since discharge, and some have married and borne children.

The number of cases reported above is admitted to be rather small for the establishment of positive conclusions. The comparative results among the

different classes on discharge have, however, been the same from year to year, and substantially the same as the aggregate results for all the years.

I believe, therefore, that we may safely conclude, from our experience at Stony Wold Sanatorium, first, that the immediate results of sanatorium treatment of children afflicted with pulmonary tuberculosis are as good as, or better than, those obtained among adult women under the same conditions; and, second, that the final results will prove to be at least as good as among our adult patients.

Children are, accordingly, entitled to the same opportunity to enjoy the benefits of sanatorium treatment as are the adults, and greater provision should be made at once throughout our country to afford them such treatment.

THE DIAGNOSTIC VALUE OF LOCAL TUBERCULIN REACTIONS

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Three years ago, on May 15, 1907, von Pirquet announced, at a meeting of the Berlin Medical Society, his discovery of the cutaneous tuberculin test, which consists of a superficial scarification of the skin through a drop of the old tuberculin, and the subsequent appearance, in those afflicted with tuberculosis, of a characteristic papule at the point of the inoculation.

The demonstration of this new diagnostic procedure was made possible by the researches of von Pirquet (and B. Schick) into the general law of "allergie," or the altered reaction of the organism toward infective agents on their reintroduction.

The "early vaccinal papule" appearing on revaccination, as well as the cutaneous papular reaction following the application of tuberculin to the skin of tuberculous individuals, were both ascribed by von Pirquet to the contact of the infectious agent with "antibodies" lodged in the integument as the result of previous infection. The "hypersensibility" of the infected organism, displayed on reinfection, was shown to be a factor in the production of the reaction, the mechanism of which is supposed to consist of the digestion of the introduced virus by the antibodies and the liberation of a toxic substance, with its inflammatory effect on the skin at the point of inoculation. While this and the Wolff-Eisner explanation of the local reaction (substituting "bacteriolysins" for "antibodies") are at present quoted by various writers, the entire question, in its theoretical and practical aspect, is still a subject of extensive investigation.

Contemporaneous with the announcement by von Pirquet of the cutaneous tuberculin reaction, came the demonstration by Wolff-Eisner and Calmette of a similar phenomenon in the conjunctiva of tuberculous individuals, and this was soon followed by various modifications of the original von Pirquet test by a number of investigators, as Moro (percutaneous test with salve containing

50 per cent. tuberculin), Lignières (rubbing in 5 or 6 drops of undiluted tuberculin into the skin), etc., all these tests being based on the now accepted idea of the wide distribution of specific antibodies in the organism of the infected individual.

The specific character of these local reactions found considerable substantiation: (1) In the postmortem statistics of von Pirquet (demonstrating tuberculous lesions in 123 out of 124 children reacting to the cutaneous tuberculin test, and 161 negative postmortem findings in 190 children with negative reactions), and in the postmortem statistics of Wolff-Eisner, Calmette, and others; (2) in the almost constant occurrence of these reactions in clinically tuberculous individuals, barring a large number of very advanced cases, miliary tuberculosis, complications by other diseases (as measles), and a few other conditions still unexplained.

The percentage of the positive conjunctival reactions in the clinically tuberculous is given as 92 by Calmette (2894 cases), 90 per cent. by Wolff-Eisner (435 cases), and 80 to 95 per cent. by numerous other observers; the percentage of the positive cutaneous reactions in tuberculous adults is given by von Pirquet as 90.

Considerable difference between the occurrence of the conjunctival and cutaneous reactions was observed in the "apparently healthy" class, the cutaneous reaction being positive in 70 per cent., even at the age of ten (von Pirquet), while of the apparently healthy adults, only 15 per cent. respond to the conjunctival test (Wolff-Eisner).

This observation led to Wolff-Eisner's and Calmette's interpretation of the positive conjunctival reaction as occurring only in active cases of tuberculosis, the comparative infrequency of the positive conjunctival reaction in the "apparently healthy" class being used by Wolff-Eisner as one of the chief arguments in favor of this contention.

The relation between the positive conjunctival reaction and the activity of the tuberculous process has not been, however, so far established (neither has it been absolutely disproved), and the most that can be said, in the light of the present experience, is that a positive local tuberculin reaction, conjunctival or cutaneous, signifies, probably in all cases, a preëxistent tubercle infection, without furnishing any conclusive information as to the active or latent character of the process.

The cutaneous test is recommended by von Pirquet for diagnosis of tuberculosis in children under two years of age, a positive reaction signifying an active tuberculous process, latent tuberculous lesions being rare in this period of life. The test, in his opinion, is not appropriate for adults,

in whom positive reactions occur in a large percentage of cases, corresponding to the increasing frequency of latent tuberculous lesions, from childhood up to maturity and old age.

The percutaneous (Moro's) test has no material advantage over the Pirquet procedure (as stated by Bandelier and Roepke and others), and is less reliable because of such drawbacks as—(1) the variable power of absorption of the skin of different individuals; and (2) a number of conditions varying with each operator (force used in application, etc.). The last objection is equally applicable to the cutaneous test; the manner of its application in all its details must be agreed upon, the scarification never to exceed the mere removal of the superficial layer, and all unnecessary injury to the skin to be avoided.

The conjunctival test, because of the possibility of its harmful effect in a certain percentage of cases, is not employed at present as extensively as before. With certain precautions, the occurrence of untoward developments may be reduced, however, to a minimum, or possibly excluded altogether. In 6303 conjunctival tests, as reported by Calmette at the International Tuberculosis Congress in Washington in 1908, he encountered 3 cases of phlyctenular keratitis, 20 conjunctivitis, and 72 prolonged reactions. Wolff-Eisner observed very few harmful effects with the use of a 1 per cent. solution of the old tuberculin in a large number of cases. Similarly, with the use of a 1 per cent. solution of old tuberculin in 500 cases (187 positive reactions; normal salt solution employed as diluent; cases of ocular disease and conjunctivitis, chronic or acute, excluded), I have seen only two instances of prolonged violent reactions without any permanent injury to the eye. Further research as to the utility of the conjunctival test may, however, be well carried on in the future, particularly by animal experimentation, until all conditions determining the conjunctival reaction are more or less fully established and a harmless method of its application is evolved.

The local tuberculin reaction is but a link in a chain of evidence pointing to the tuberculous character of a suspected lesion, and the value of its occurrence can be adjudged only by a comprehensive study of the entire evidence in each individual case: the clinical history, physical signs, etc.

Considerable clinical study and further extensive autopsy experience are still needed in order to establish the relation of the local reaction to the active and latent tuberculous processes and the various types of tuberculous disease. The conditions determining the reaction itself, as well as the rapidity and degree of its development in various types of cases, are still a fruitful field for research, if the local reaction is to gain the position of practical diagnostic procedure.

During the last two years I employed, at the Edward Sanatorium, at

Naperville, Ill., and in my dispensary and private practice, the local and subcutaneous tuberculin reactions in a variety of tuberculosis cases. For the conjunctival test a drop of a solution of Koch's old tuberculin in an 0.8 per cent. sterile physiological salt solution was used; for the cutaneous test, undiluted old tuberculin; dilutions of old tuberculin of various strengths (in 0.5 carbolic acid solution) were employed cutaneously for differential study of results with various dilutions in the same individual. For the percutaneous test (Moro) an ointment consisting of equal quantities of Koch's old tuberculin and anhydrous lanolin was employed.

In applying the conjunctival test the technique, as recommended by Wolff-Eisner, was closely followed; for the cutaneous reaction the superficial layer of the skin of the forearm (anterior surface) was gently scarified, by turning the von Pirquet's inoculation needle through a drop of the old tuberculin; in applying the percutaneous (Moro) test a piece of the ointment, the size of a pea, was rubbed into the anterior surface of the forearm. The results were generally observed at the end of twelve and twenty-four hours, and, after that, daily for several days.

The conjunctival reactions were classified in their degree according to the schema of Citron ("Tuberculosis in Diagnosis and Treatment," by Bandelier and Roepke, p. 24). Similar classifications are offered by Comby, Edward R. Baldwin, etc.

+ Reddening of the caruncle and palpebral conjunctiva.

+ + Intenser reddening with involvement of the ocular conjunctiva and increased secretion.

+ + + Intense reddening of the whole conjunctiva, with chemosis, much fibrinous and purulent secretion, small ecchymoses, etc.

For the results of the percutaneous test, Moro's classification was used (see same reference, p. 17).

Slight reaction—single isolated, more or less distinct, reddened spots, visible twenty-four to forty-eight hours after the inunction, and only on careful inspection, disappearing in a few days.

Well-marked reaction—papules, indistinguishable in degree of hyperemia and exudation from those of the cutaneous inoculation, or coalescing red nodules on inflamed base.

Intermediate reaction—30 to 50 or more discrete miliary nodules with reddened areola.

The size of the papule, the degree of redness and elevation were recorded in describing the cutaneous reactions.

This paper deals with some of the features of the local tuberculin reactions,

as influenced by the site of the inoculation, the degree of the tuberculin dilution, the stage of the disease, and the state of resistance; in a group of cases the local tuberculin reactions are compared with the results of the subsequent subcutaneous injections of tuberculin.

THE SITE OF THE LOCAL TUBERCULIN INOCULATION AS A FACTOR DETERMINING THE DEGREE OF THE REACTION

In applying the von Pirquet test to the skin, the degree of the reaction varies frequently, according to the site selected, in its extent, injection, elevation, and rapidity of development. Exceptions, however, occur to the observations stated below, the reaction at times being more marked in locations where the reverse is usually the rule.

In all, 140 applications of tuberculin were made in 55 cases of pulmonary tuberculosis (mostly in the first stage of the disease).

In 10 cases tuberculin was applied simultaneously to the anterior surface of the arm and the interscapular space, the dilutions of 10 and 25 per cent. and undiluted tuberculin (two inches apart) used in a straight line in both locations. In 5 of these cases the reactions were slightly more pronounced in size in the interscapular space; in 3, practically no difference; in 2, the reactions were slightly more marked on the arm.

In 12 cases undiluted tuberculin was applied to the anterior surface of the forearm and the interscapular region on the same side. Invariably the reaction in the interscapular region was more extensive, generally redder, and in 2 cases more elevated (the average diameter of the interscapular reaction, 16.5 mm.; forearm, 10 mm.).

In 12 cases undiluted tuberculin was applied to the posterior surface of the left leg and the anterior surface of the left forearm, with a resulting more marked reaction in the first-named location in 9 cases (average diameter, 12.5 mm.; forearm, 9.5 mm.).

Slightly more marked reaction was observed on the left forearm in 4 cases, where undiluted tuberculin was simultaneously applied to the anterior surfaces of left and right forearm.

In 12 cases a 25 per cent. dilution of tuberculin was simultaneously used on the anterior surfaces of the thigh and arm, with a resulting more marked reaction on the thigh in 9 cases (average diameter, 12.5 mm.; arm, 9.5 mm.).

More marked reactions were also observed below the mammary gland than on the anterior surface of the forearm.

It is evident, from observations made by numerous investigators, that the

anatomical conditions of the skin and mucous membrane in various locations of the body (the histological structure, circulation, lymphatic system, nerve-supply, etc.), as well as greater cutaneous sensitiveness displayed by some individuals to slightest mechanical or chemical irritation, have their influence in determining the degree of the reaction; they are factors of importance, and an accurate interpretation of the local reactions is impossible without giving due consideration to these varying conditions.

THE STRENGTH OF THE TUBERCULIN SOLUTION AS A FACTOR DETERMINING THE DEGREE OF THE CUTANEOUS REACTION

One hundred and four cutaneous applications of tuberculin, of various dilutions, were made, according to von Pirquet's directions, in 46 cases of pulmonary tuberculosis (20 in the incipient stage, 26 moderately advanced).

In 34 of these cases a 25 per cent. solution and one of undiluted tuberculin were simultaneously applied to the anterior surface of the left forearm, two inches apart, the scarification being made with a separate instrument through a drop of each dilution. The resulting reactions were as follows: (*a*) Size of the papule, with undiluted tuberculin, decidedly larger in 14 cases (with undiluted tuberculin the diameter was 12.5 mm.; with 25 per cent., 7.5 mm.); smaller in 12 (with 25 per cent., 13.5 mm.; with undiluted, 9.5 mm.), same size with both dilutions in 8 cases; (*b*) elevation of the papule, with undiluted tuberculin, greater in 10 cases, smaller in 6, same in 18; (*c*) redness, with undiluted tuberculin, more pronounced in 4 cases, same in 30.

In 12 cases a 10 per cent. dilution, a 25 per cent., and undiluted tuberculin were simultaneously applied to the anterior surface of the left forearm. The resulting papule was larger in size, with undiluted tuberculin, in 6 cases; larger, with 10 per cent., in 4; the same with all dilutions in 2. The elevation was more marked with undiluted tuberculin in 6, with 10 per cent. in 2, the same in 4. Redness more pronounced with undiluted tuberculin in 8, with 10 per cent. in 2, the same in 2.

The manner of the application and the actual amount of tuberculin absorbed are seemingly important factors in determining the degree of the reaction.

In all our cases an attempt was made to make the scarification superficial and uniform with all dilutions. The drop was left undisturbed for five minutes after the inoculation, the excess of tuberculin around the point of inoculation being removed at the end of that time.

A more reliable interpretation of the cutaneous reaction may be possible with an improved technique, in which a small, measured quantity of tuberculin should be used for cutaneous inoculation, under conditions facilitating its complete absorption.

THE ANATOMICAL EXTENT OF THE DISEASE AND THE STATE OF RESISTANCE OF THE INDIVIDUAL AS FACTORS DETERMINING THE DEGREE OF THE LOCAL TUBERCULIN REACTION

From the experience of numerous observers we know that, as a general rule, reactions on application of tuberculin grow less pronounced and occur less frequently with the anatomical progress of the disease from the incipient to the far-advanced stage. The "antibody" theory of tuberculin reactions explains this by the gradual failure of the organism to respond to tuberculin stimulation.

The anatomical extent of the disease is, however, not always indicative of the coexistent state of resistance of the individual. In numerous cases, with most extensive signs, particularly in those where the process is very chronic and the general condition is favorable, the local tuberculin reaction is frequently very pronounced, while the reaction fails or is very slight in a certain percentage of anatomically incipient cases.

In statistics covering thousands of cases the classification "first," "second," "third," stage is synonymous, of course, with the gradual impairment of resistance and decline of response to tuberculin, from stage to stage, as various factors counterbalance each other in large groups of cases. In observation of individual cases, however, this power or failure of response to local tuberculin application is frequently at variance with the stage of the disease.

I append here, as an example, an experience with a group of cases classified according to stage (provisional schema of the National Association for the Study and Prevention of Tuberculosis) and observed for periods of one to two years subsequent to tuberculin application. This group included a number of advanced cases characterized by chronicity of process and favorable general condition.

In 165 cases of pulmonary tuberculosis (99 incipient, 36 moderately advanced, 30 far advanced) the conjunctival reaction was positive (traces of reaction included) in 67 per cent. of the incipient, in 33 per cent. of the moderately advanced, and 67 per cent. of the far advanced; the cutaneous reaction, positive (diameter above 5 millimeters) in 69 per cent. of the incipient, 41 per cent. of the moderately advanced, and 67 per cent. of the far advanced.

The average diameter of the inoculation papule in the first-stage cases was 12 mm.; second, 13 mm.; third, 11.5 mm.; the comparison showing very little variation for the three stages of the disease.

With the conjunctival test, more pronounced reactions were obtained in the second stage (48.5 per cent. of the positive cases more than +) than in the first (28 per cent. more than +). Very slight difference in the degree of the percutaneous reaction was observed in 40 first-stage cases and 29 second. These figures have reference, of course, only to a limited number of cases divided according to stage; their analysis suggests, however, that the mere anatomical extent of the disease does not give a definite idea of the resistance of the patient and sensibility that may be displayed on application of tuberculin.

Dividing these 165 cases into three groups, regardless of the anatomical extent of the disease,—(1) progressive cases, good general condition; (2) stationary, good general condition; (3) far advanced, hopeless,—the percentage of the positive reactions is readjusted in the following way: first class, conjunctival positive in 75 per cent.; cutaneous, in 70 per cent.; second class, conjunctival positive in 35 per cent.; cutaneous, in 82 per cent.; third, conjunctival trace in 10 per cent.; cutaneous positive in 33 per cent.

Observations on various groups of cases lend support to the general idea that the tuberculin reaction fails with the gradual exhaustion of the defensive elements of the organism, and the anatomical extent of the disease is important only in the measure in which it is operative in producing this condition. This is offered as an observation, familiar to many, without any attempt at evolving a general diagnostic or prognostic schema based on the degree of the local tuberculin reaction. Experience, however, tends to substantiate in a large number of cases the dictum of Wolff-Eisner that a negative local tuberculin reaction, in the presence of decided physical signs, is of unfavorable augury, pointing, as it does, to the inability of the organism to counteract the toxins of the tubercle bacilli; while a positive reaction means simply that the defensive elements are in existence, the battle is still being fought, but the result cannot be predicted.

REPETITION OF THE LOCAL TUBERCULIN TEST DURING THE COURSE OF THE DISEASE; INTERPRETATION OF THE RESULTING REACTION

It is evident, from the consideration of the conditions determining the occurrence and the degree of the local reaction, that various factors influence

the result of the repeated local tuberculin test. Of these, the following may be considered:

(*a*) *The hypersensibility*, occasioned by a previous inoculation of tuberculin into the skin or conjunctiva, is a factor of considerable importance. Fritz Levy (see "The Ophthalmic and Cutaneous Diagnosis of Tuberculosis," by Dr. Alfred Wolff-Eisner, chapter on the Repetition of the Reaction) was the first in Germany to call attention to the fact that, on the second application of the conjunctival test, hypersensibility is manifested in 70 per cent. of cases, the condition becoming operative three days after the first instillation; this phenomenon was observed also on repetition of the cutaneous reaction. The exact duration of this hypersensibility is still undetermined. Experience shows that in a large percentage of cases the conjunctival test repeated in the other eye is positive, while the first reaction was negative, and the same is true of the cutaneous test. To what extent and in what manner the first introduction of tuberculin influences the result of the second application at another site is still a question open to further investigation. We know, however, that the local changes produced by the first application of tuberculin are operative for a considerable period of time, as manifested by the reinflammation of the local tuberculin reactions, on subcutaneous injection of tuberculin, months after the local test was performed. In 90 subcutaneous injections of tuberculin in a corresponding number of incipient closed cases of pulmonary tuberculosis, with the resulting characteristic constitutional reaction in 80 cases (doses OT from 0002 c.c. to 005 c.c.), reinflammation of the conjunctival reaction occurred in 54 cases, cutaneous in 74. The reinflamed conjunctival reaction was more pronounced than the original in 46 cases, same in 6, slighter in 20; cutaneous, more pronounced in 46; same in 8; slighter in 20. The size of the reinflamed cutaneous spot in many cases was two to five times larger than the original, and this, with the injection done two to four months after the application of the local test. Approximately the same experience was obtained with the percutaneous (Moro) test. The reinflammation of the reaction spots may be due to the presence of a larger number of antibodies or bacteriolysins near the cutaneous or conjunctival focus of deposited tuberculin. In what measure or manner this focus of deposited tuberculin influences the result of subsequent tuberculin inoculation at another cutaneous or conjunctival site is still a matter of speculation.

(*b*) *The interval between the first and second applications of tuberculin. Improvement in the general condition of the patient as a factor influencing the degree of the repeated reaction.* With the progress of a large proportion of tuberculosis cases, under sanatorium or home care, toward improvement, it is interesting to note the difference between the results of the first and the

following local tuberculin tests as applied at various intervals. In 52 cases of pulmonary tuberculosis (34 incipient, 10 moderately advanced, and 8 far advanced) the conjunctival test was repeated in the other eye at intervals not exceeding one month from the date of the first application, with the resulting increase in the degree of the reaction over the first test in 30 cases out of 52 (this includes also cases found negative on the first application and positive on the second); of 26 cases in which the second instillation was performed from one to six months later, an increase in the degree of the reaction was noted in 8, suggesting the explanation that the larger number of more pronounced second reactions in the first month following the first application is dependent on the hypersensibility resulting from the first instillation, a hypersensibility the duration of which is yet undefined.

Approximately the same result was obtained with the cutaneous test: increase in the degree of the reaction in 22 cases out of 38, with repetition of the test during the first month; and in 18 cases among 42, with the second test applied from one to five months later.

In analyzing the effect of the improvement of the general condition of the patient on the result of the repeated local tuberculin test, the proximity of the dates of both tests shows itself again to be a factor of great importance. With a gain of less than 10 pounds in weight, subsequent to the first tuberculin application, the second conjunctival reaction was more pronounced in 20 cases out of 32; with a gain of 10 to 30 pounds—in 14 out of 38; an increase in the degree of the cutaneous reaction occurred in the first class of cases in 18 out of 36; in the second class, in 12 out of 26; the smaller increases in weight occurring in the first few weeks subject to the first tuberculin application, the greater increases, in the following four to five months.

A proportionally larger number of more pronounced second reactions was observed in incipient cases; the least deviation in the far advanced, regardless of gain in weight.

It may be expected that the improvement in the general condition of the patient, presumably productive (always?) of an increase in the defensive elements of the organism, would show itself in a more vigorous reaction on the introduction of tuberculin, and this is probably the case; in many instances, however, a mere increase in weight may not be coincident with a greater production of defensive antibodies, as shown by the progressive course of a large percentage of tuberculosis cases regardless of enormous increases in weight.

The relative influence of—(1) The state of hypersensibility resulting from the first tuberculin application; and (2) of the increased resistance (as suggested by improved nutrition, recession of the physical signs, etc.), on the result of

the repeated local tuberculin test, is still a matter in need of further investigation.

In studying the results of the local tuberculin tests when applied—(1) to various groups of tuberculosis cases (differing in extent and activity of the process, state of resistance, previous use of tuberculin, etc.), as well as (2) at the various stages of improvement or further progress of individual cases, it becomes evident that numerous conditions operate in determining the occurrence and the degree of the resulting reaction. If the present theory of the local tuberculin reaction (based on the assumption of the wide distribution of specific antibodies or bacteriolysins in the infected organism) is correct, all the above-mentioned conditions are factors to the extent to which they stimulate the production of these specific substances and influence the sensibility of the organism to the infectious agent and its toxins.

THE DIAGNOSTIC SIGNIFICANCE OF THE LOCAL TUBERCULIN REACTION AS CONTROLLED BY A SUBSEQUENT SUBCUTANEOUS INJECTION OF TUBERCULIN

(*a*) In 30 incipient pulmonary closed cases in which the conjunctival reaction was positive (21+, 9++), the cutaneous at the end of forty-eight hours fully developed and strong (average diameter, 13.5 mm., pronounced redness and distinct elevation in 60 per cent.), the percutaneous positive in 14 out of 18 (4 slight, 4 intermediate, and 6 marked), the subcutaneous test was positive in all, 6 responding to $\frac{1}{5}$ milligram OT, 18 to 1 milligram, 6 to 3 milligrams. Average rise of temperature, 0.9° F.; symptoms in 24; focal reaction in 4. Average dose of OT, 1.2 milligrams. Marked reinflammation of the conjunctival and cutaneous reaction in 30 (18++, 12+; average diameter of the reinflamed cutaneous spot, 27.5 mm.).

(*b*) In 12 cases of the same class, with the conjunctival—trace in 12, the cutaneous rapid and marked in all (average diameter, 13.5 mm.), the percutaneous positive in 9 (3 slight, 4 intermediate, 2 marked)—the subcutaneous test was positive in 10, 9 cases responding to 1 milligram and 1 case to 3 milligrams. Focal reaction in 1; symptoms in 8. Average rise of temperature after the injection, 1.5° F.; average dose of tuberculin used, 1.4 milligrams, still showing that, regardless of the doubtful conjunctival reaction in these cases, the subcutaneous test was positive with approximately the same dose of tuberculin as in the first group of cases.

Reinflammation of 6 conjunctival reactions (6+) and 9 cutaneous (average diameter, 42 mm.).

(*c*) In 24 cases of the same class, with the conjunctival—trace in 24, the cutaneous slight (average diameter, 7.5 mm.), the percutaneous positive in 2 out of 7 (1 trace, 1 slight)—the subcutaneous test was positive in 21 cases (6 responding to 1 milligram, 6 to 3 milligrams, 6 to 5 milligrams, and 3 to 10 milligrams). Average dose of tuberculin, 4 milligrams; average rise of temperature after the injection, 0.6° F. Focal reaction in 1, symptoms in 15.

Reinflammation of 8 conjunctival reactions (3 traces, 5+) and 13 cutaneous (average diameter, 12.5 mm.).

(*d*) In 12 cases of the same class, with the conjunctival positive in all (7+ and 5++), the cutaneous positive in 6 (average diameter, 6.3 mm.) and negative in 6 (positive on repetition; average diameter, 9.5 mm.), the percutaneous applied to 3 (3 traces), the subcutaneous test was positive in 9 cases (1 responding to $\frac{1}{10}$ milligram, 2 to $\frac{1}{2}$ milligram, 2 to 3 milligrams, and 4 cases to 5 milligrams). Average rise of temperature after the injection, 1.5° F.; average dose of tuberculin used, 3 milligrams. No focal reactions observed; symptoms in 7.

Reinflammation of 6 conjunctival (3+, 3++) and 4 cutaneous (average diameter, 25.4 mm.).

(*e*) In 9 cases of the same class, with the conjunctival test negative (6+ on repetition in the other eye), the cutaneous rapid and marked (average diameter, 16.9 mm.), the percutaneous applied to 3 (3 slight), the subcutaneous was positive in 9 (3 cases to 1 milligram and 6 to 3 milligrams). Focal reaction in 2; symptoms in 9. Average rise of temperature after the injection, 0.9° F.; average dose of tuberculin, 2.3 milligrams.

Reinflammation of 4 conjunctival reactions (3+, 1++) and 6 cutaneous (average diameter, 25.4 mm.).

(*f*) In 12 cases, with the conjunctival negative in 9, trace in 3 (6 of the negative + on repetition); the cutaneous negative in 9, trace in 3 (5 of the negative, positive on repetition with 9.5 mm. as the average diameter); the percutaneous positive in 1 out of 4—the subcutaneous test was negative in 6 (to 5 milligrams) and positive in 6 (1 case to $\frac{1}{5}$ milligram and 5 to 5 milligrams). Average rise of temperature after the injection, 1.6° F.; average dose of tuberculin, 4.7 milligrams. Symptoms in 4; focal reaction in 1 (with $\frac{1}{5}$ milligram).

Reinflammation of 5 conjunctival (2 trace, 3+) and 4 cutaneous (average diameter, 9.5 mm.).

An analysis of these cases points to the high probability of positive subcutaneous reaction, with correspondingly smaller doses of tuberculin in a large number of cases reacting promptly and distinctly to the cutaneous test; hence the relative value of the marked cutaneous reaction as a positive test

in cases in which the subcutaneous test cannot be applied for various reasons.

The focal reaction occurred only in 10 per cent. of cases tested subcutaneously; adding to this number an experience with 30 more positive hypodermic tests in incipient pulmonary cases, we get in all 12 per cent. of focal reactions under the average conditions of observation.

In the light of the autopsy experience of von Pirquet, Wolff-Eisner, Calmette, and others, the cutaneous tuberculin reaction in adults discloses tuberculosis only in the anatomical sense; the test, with its present method of application, sheds little or no light on the active or latent character of the tubercular lesion.

Where a focal reaction is desired,—and that can be obtained in only a certain percentage of cases,—the cutaneous test cannot supplant the hypodermic. It can be used, however, as a preliminary diagnostic measure, being absolutely harmless, compared with the conjunctival test, and more reliable than the percutaneous reaction, which fails in a large number of cases.

CONCLUSIONS

1. A vast amount of clinical experience, gathered by numerous observers and substantiated in a proportion of cases by postmortem findings, points to specificity of the local tuberculin reactions.

2. The verdict of today is that a positive reaction, following the local application of tuberculin (conjunctival or cutaneous), signifies the existence of a tuberculous focus somewhere in the organism, without giving a definite idea of the active or latent character of the process.

3. Reactions, occurring on application of tuberculin, differ in their degree, according to various sites of the body selected as points of inoculation; a comparative study of the results obtained by numerous observers is possible only with a clear description in each individual case of the site practised on.

4. The results of cutaneous tests, performed with various dilutions of tuberculin, contribute to the belief that the actual amount of absorbed tuberculin is a factor of importance in determining the degree of the reaction.

Sufficient evidence has not been produced so far to substantiate the claim that a positive conjunctival reaction signifies active tuberculous disease. The possibility, however, exists that activity of a tuberculous process may be a factor in causing a positive local reaction with a minimal dose of tuberculin, under certain conditions of the power of response. Hence the failure of conjunctival test in the clinically healthy and its uniform occurrence in the clinically tuberculous (barring the very advanced cases, etc.).

If this contention has any foundation, a positive cutaneous reaction ought to be possible in active cases of tuberculosis, with minimal doses of tuberculin (greater dilutions).

Further experience with the cutaneous test, with various dilutions of tuberculin, applied to various groups of cases with a perfected technique, assuring thorough absorption of a definite quantity, may possibly lead to some method of differentiation of active and latent cases.

5. Cases of suspected tuberculosis, in which the cutaneous reaction is rapid in development and marked in degree, generally respond readily to the subcutaneous injections of minimal doses of tuberculin; hence the relative value of the cutaneous tuberculin test in cases in which the employment of the subcutaneous test is, for some reason, contraindicated.

6. The subcutaneous test remains the decisive diagnostic procedure in doubtful cases of tuberculosis, particularly if a focal reaction is desired. The possible unfavorable effects of this test in some cases may be avoided by the use of small doses of tuberculin (initial, $\frac{1}{5}$ or even $\frac{1}{10}$ milligram), according to the age and condition of the patient.

7. The work of von Pirquet, Wolff-Eisner, and Calmette opened a new field for further clinical and laboratory research, out of which may be evolved a safe, reliable method of diagnosis of the obscure and the very incipient cases of tuberculosis.

THE RELATION OF THE CUTANEOUS TO THE SUBCUTANEOUS TUBERCULIN TEST

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In spite of the large amount of work that has been done with the tuberculin tests, much remains unsettled regarding their exact diagnostic significance and their relative value. During the past year the medical students of the University of Michigan were examined for tuberculosis, and as a part of the examination, 288 received the cutaneous tuberculin test. These, together with the 242 cutaneous tests and 84 subcutaneous injections, which were made on hospital patients, constitute the material upon which this paper is based. The results may be expected to differ from those obtained in institutions caring solely for tuberculous patients, because they were obtained in part upon a group of young healthy adults and in part upon patients entering a general hospital mainly for diagnostic purposes.

Tests were made as follows: Koch's old tuberculin was diluted with sterile salt solution to strengths of 1 per cent., 5 per cent., and 25 per cent. The anterior surface of the forearm was cleaned with ether, and a drop of each solution placed on the skin, the drops being 3 or 4 cm. apart, with the strongest toward the hand. Von Pirquet's platinum chisel was then sterilized in a flame, and an abrasion made through each drop of tuberculin, attempting to draw a small amount of serum without causing the escape of blood. In order to obtain a uniform scarification the skin was stretched slightly by means of the left hand on the back of the patient's arm. After making the abrasions through the tuberculin solutions, very small wisps of sterile cotton were pressed down upon the drops, and these were left in place until dry. The arms were then inspected at intervals from the first to the sixth day. For a time controls of salt solution, were used, but as no reaction ever appeared they were omitted, the later controls consisting of simple abrasions of the skin about 3 cm. above the point where the weakest dilution of tuberculin was placed.

A temporary hyperemia representing the reaction to the mechanical irritation of the skin begins within a few minutes and often lasts a few hours. In

from five to twenty-four hours a pale pinkish-yellow raised area begins to surround the abrasion, and this in turn is surrounded by a second halo of brighter pink. The maximum reaction occurs at a time varying from one to three days, and may subside on the third day, or there may persist for two or three weeks a dusky-red, indurated area from the center of which there occurs a slight desquamation of the epithelium. The induration and elevation vary considerably, but are quite marked in definite reactions. Numerous variations in appearance and in duration of the reaction occur. In a few patients very definite vesiculation was noted about the abrasion, which showed a distinct, crater-like depression. This was especially pronounced in one patient, who was suffering from an acute generalized tuberculosis. In ten of our cases there were many small papules in the hyperemic area, and in several other fairly typical reactions there were five or six outstanding papules. In some cases there was a marked irregularity in the outline of the inflammatory area, with at times several radiating streamers of redness and infiltration, indicating an extension along the lymphatic vessels. The size of the papule which develops from the same strength of tuberculin varies widely in different cases, but in any one case the diameter of the hyperemic zone is roughly proportional to the strength applied. In our cases it was especially noticeable that in nearly all cases which gave a reaction there was a gradual gradation in the size of erythema from the weaker to the stronger dilutions, and while in one or two of the more violent reactions the bright areola which surrounded the papule proper was nearly as large in the 5 per cent. as in the 25 per cent., the central indurated area and the residual dusky papule were invariably larger in the stronger solutions. This gradual gradation from smaller to larger papules, the fiery bright pink nature of the reaction, and the persistence of a dusky red papule for many days we consider of more value in indicating sensitiveness to tuberculin than the actual width of the individual papules.

Table I gives a summary of the results obtained in 530 cutaneous tests. Cases were considered negative when no redness resulted from any dilution, slight or doubtful when an area of 2 to 4 mm. about the strongest dilution showed a slight hyperemia with very little induration, and positive when the reddened area from the strongest dilution reached a diameter of 5 mm. or more.

TABLE I.—CUTANEOUS REACTION

	Cases	Per Cent. of Total	Per Cent. of Positive
Negative	318	60	
Slight or doubtful	26	5	
Total positive	186	35.0	
Positive to 25 per cent. only	43	8+	23.1
Positive to 5 per cent. and 25 per cent. only	73	13.8	39.3
Positive to 1 per cent., 5 per cent., and 25 per cent.	70	13.2	37.6

Table II gives the results of the cutaneous tests on 288 students:

TABLE II

Class	Freshman	Sophomore	Junior	Senior	Total
Number	50	108	78	52	288
Average age	21	23	24	26	
Negative	40	70	50	24	184
Slight or doubtful	1	4	2	5	12
Positive to 25 per cent. only	2	15	10	11	38
Positive to 5 per cent. and 25 per cent.	4	15	14	11	44
Positive to 1, 5, 25 per cent.	3	8	2	1	14
Total positive	9	38	26	23	96
Per cent. positive	18	35	33⅓	44	33⅓

About 10 per cent. of the students gave a suspicious history or suspicious signs of tuberculosis.

The variation in the number of positive reactions in the different classes is rather striking, with 18 per cent. in the freshman class and 44 per cent. among the seniors. Age probably plays only a small part in this difference, as it has been shown that after the age of fifteen or sixteen years the rate of increase in the number of positive reactions is very slow. Probably the hard study, confinement in laboratories and lecture rooms during the day, and in poorly ventilated rooms at night, the association with and examination of patients with tuberculosis during the last two years of the medical course, have much to do with it. The sudden rise from the freshman to the sophomore class, with the slight drop between the sophomores and juniors, may be explained in part by the fact that, as a matter of convenience, the freshman and junior classes were given the test early in the year, while the sophomores and seniors were tested during the latter part of the year.

Table III gives the results of 242 cutaneous reactions in hospital cases, together with a rough clinical classification.

TABLE III

Clinically	Number of Cases	Positive	Per Cent. Positive	Negative	Doubtful
I. Non-tuberculous	133	21	15.8	102	10
II. Suspicious	42	18	43	21	3
III. Early and moderately advanced	45	41	91	1	3
IV. Advanced	22	14	64	5	3
V. Cases with bacilli	30	27	90	2	1

Of 133 non-tuberculous patients, 15.8 per cent. gave positive reactions. This is a much lower percentage than has usually been obtained in adults. The percentage of positive reactions in students was 33⅓, and in the whole series of 530 cases 35 per cent. were positive. These low percentages may pos-

sibly be explained by the fact that a 25 per cent. solution is weaker than the solutions used by many others, and also by the fact that we had a comparatively large class of doubtful reactions with an areola less than 5 mm. in diameter. Individual variations in technique and in interpretation of results also account for some of the discrepancies in different reports. Of the early and moderately advanced cases, 91 per cent. gave positive reactions, while of the well-advanced cases, only 64 per cent. were positive. Of the cases with bacilli, 90 per cent. were positive. These results agree very closely with those obtained by others.

Attempts to vary the strength of tuberculin in the hope of finding one to which only patients with active tuberculosis will react have not met with much success. By referring to Table I it is seen that in 186 cases which gave positive reactions, 43 were positive to 25 per cent. alone, 73 to 5 per cent. and 25 per cent., and 70 were positive to all dilutions. The cases reacting to 1 per cent. were not limited to the clinically tuberculous class, and those who reacted only to 25 per cent. included many of those with manifest tuberculosis, so that it does not seem possible to use a strength of tuberculin which will decide whether a process is active or not. Our results agree with those of Hamman and Wolman,* who were also unable to find a strength of tuberculin which would give reactions in active cases, but would be negative in cases with latent or healed lesions. Ellerman and Erlandsen† believe that a cutaneous reaction to a 1 per cent. solution indicates an active process, for with this strength they obtained positive reactions in 83 per cent. of clinically tuberculous patients, and negative reactions in 83 per cent. of healthy individuals. While we cannot go as far as these authors, we believe that the dilution of the tuberculin adds to the clinical value of the reaction, the lower dilutions giving a lower number of positive reactions in clinically non-tuberculous patients, without excluding a proportionate number of those with manifest disease.

The relation of the cutaneous to the subcutaneous tuberculin test has attracted considerable attention in the past few years. Hamill, Carpenter, and Cope,‡ in a series of cases in children, found a close agreement between them, and F. T. Lord§ has noted a general agreement between the skin, eye, and subcutaneous tests. Hamman and Wolman‖ found a closer agreement between the skin and subcutaneous tests than between either the eye and skin tests, or the eye and subcutaneous tests. They were unable, however, to predict the result of the subcutaneous injection from the results of the local

* *Arch. Int. Med.*, 1909, iii, 307.
† *Deut. med. Woch.*, 1909, **xxxv**, 436.
‡ *Arch. Int. Med.*, 1908, ii, 405.
§ Pub. of Mass. Gen. Hosp., October, 1909, ii, 702.
‖ *Arch. Int. Med.*, 1909, iii, 307.

skin reaction. Lawrason Brown* states that there is no relationship between the size of the erythema produced by varying strengths of tuberculin when applied to the skin and the amount necessary to cause a subcutaneous reaction. On the other hand, White, Graham, and Van Norman,† who measured very carefully the amount of tuberculin applied to the skin, believe that they found a very definite mathematical agreement between the absolute amount of tuberculin necessary to give a "minimal cutaneous reaction" and the amount that would give general and local symptoms when injected subcutaneously.

In 84 of our hospital cases the cutaneous test was followed by a subcutaneous test. In choosing the dose for the latter we were guided somewhat by the results of the cutaneous reaction. A patient who gave no cutaneous reaction was given a subcutaneous injection of either 5 or 10 mgm. of tuberculin. Many of the cases which gave no symptoms following the injection of 5 mgm. were given 10 mgm. three days later. Patients who gave a moderate cutaneous reaction were given 2 or 3 mgm. subcutaneously, while those who gave violent skin reactions were given 1 mgm. subcutaneously. In some of these cases the dose was repeated if there was any doubt as to the occurrence of a reaction, or a second somewhat larger dose was given. Graphic charts were kept for twenty-four hours preceding and forty-eight hours following the injection. A reaction was considered positive if the temperature rose more than one degree above the patient's normal temperature for that time of the day with definite general and local symptoms. Focal signs were carefully watched for, although we could be sure of them in but a small proportion of our general reactions.

Table IV gives the comparative results of the two tests in 84 cases.

TABLE IV.—CASES GIVEN BOTH CUTANEOUS AND SUBCUTANEOUS TESTS.

Cutaneous.	Subcutaneous.			
	Number of Cases	Positive	Negative	Doubtful
Negative	41	1	40	
Slight or doubtful	3	1	1	1
25 per cent. positive	..	..	..	..
25 and 5 per cent. positive	18	17	..	1
25, 5, and 1 per cent. positive	22	19	..	3
Total positive	40	36	..	4

It will be seen that there was a marked agreement between the results of the two reactions. Of 41 cases with negative skin reactions, only one reacted to a subcutaneous injection, while of the 40 cases giving positive cutaneous

* *Proc. Assn. Amer. Phys.*, 1909, xxiv, 104.
† *Jour. Med. Research*, September, 1909, xxi, 255.

tests, 36 were positive and 4 doubtful on subcutaneous injections. It is possible that some of these last, as well as some of those who failed to react to the cutaneous tests, might have given subcutaneous reactions had more injections been given. The patients who gave marked cutaneous reactions, especially to the weaker solutions of tuberculin, almost invariably proved very sensitive to subcutaneous injections. We were, therefore, able to confirm the fact that a general and fairly close agreement exists between the results of the two tests. On the other hand, our results do not support the view that the width of erythema from a definite strength of tuberculin when applied to the skin can be taken as an absolute guide in measuring the results of a subcutaneous dose of tuberculin. The general appearance of the cutaneous reaction, especially the acute, fiery nature of the erythema, and the residual dusky papule, together with a gradual increase in diameter and elevation of the papules from the weaker to the stronger dilutions, seems to us to be a better indication of what is to be expected from the subcutaneous injection than does the width of the erythema resulting from the application of one strength.

While at best the various tuberculin tests merely indicate sensitiveness to tuberculin and are only an accessory aid in diagnosis, we believe, from our results, that the skin reaction has been receiving more than its just share of censure when compared with the subcutaneous test. The main objection against the skin test has been that it is positive in such a large proportion of apparently healthy adults as to invalidate it for diagnostic purposes. The use of graded strengths of tuberculin and a somewhat more critical attitude regarding what shall be called a positive reaction will, however, cut down the number of positive results and give us definite information of the patient's sensitiveness to tuberculin. Subcutaneous tests are also positive in a large proportion of apparently healthy adults, as has been shown by Franz* and others. Franz's statistics on recruits are interesting because they are comparable with those we obtained on students. His subcutaneous doses did not exceed three milligrams, and yet he obtained positive reaction in over 38 per cent. of soldiers coming from a district relatively free from tuberculosis, and in from 61 to 76 per cent. of soldiers coming from an infected district. A later study showed that only a small percentage of those who reacted developed manifest tuberculosis during the next eight years, and that those who reacted were only moderately more liable to the disease than were those who did not react. Not only do apparently healthy individuals frequently react to tuberculin tests, but all agree that any of the reactions may fail in advanced stages of the disease. For these reasons no positive nor negative test should in any way supplant a careful history and examination of the patient.

* *Wien. klin. Woch.*, xxii, 991.

Keeping in mind these limitations, which apply more or less to all tuberculin reactions, the cutaneous test has certain material advantages over the others. It is easily and quickly given, is easily observed, and is free from any danger of serious consequences. It is applicable to many cases to which a subcutaneous test cannot be given, such as patients with afternoon temperature, meningeal or spinal cord symptoms, recent hemoptysis, etc. Strict control of the patient following the test is not necessary, as it is after subcutaneous injections, and finally a number of tests with different strengths of tuberculin may be given simultaneously, so that we obtain a rough quantitative idea of the patient's sensitiveness to tuberculin. One of the chief disadvantages of the cutaneous test seems to be the absence of signs at the tuberculous focus during the reaction. While these signs, if present after a subcutaneous injection, are extremely valuable, it has not been easy, in our experience, to be certain of them in many cases. The cutaneous test is of value in indicating suspicious cases when a large number of supposedly healthy individuals are to be examined. Those who react should be examined and followed with especial care, while those who fail to react are, for the most part, free from the disease. When a subcutaneous injection seems desirable, a preliminary skin reaction will indicate fairly accurately a person's sensitiveness to tuberculin and will save time, which might be spent in giving small initial doses or will give a warning of the unpleasant symptoms which might result from a large initial subcutaneous dose.

CONCLUSIONS

1. The skin tests in adults should not be discarded as an index to tuberculin sensitiveness. In our hands it has given results which have agreed very closely with those obtained by the subcutaneous test, and it can be given in many cases in which a subcutaneous test may not be convenient or advisable.

2. The use of different dilutions greatly improves the accuracy of the test, but no definite dilution of the tuberculin will differentiate active from latent or healed processes, and the test cannot replace other methods of study and diagnosis.

3. Much delay in using low initial subcutaneous doses may be avoided by using a preliminary skin test.

AN INDIVIDUAL QUANTITATIVE BASIS FOR DOSAGE IN TUBERCULIN TREATMENT

By Wm. Charles White, M.D., and K. H. Van Norman, M.D.

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Two years ago, in a discussion at the National Association meeting,* we called attention to the fact that all the surface cells, at least, of the body, were in a condition of sensitiveness to the application of the poison which we know today as tuberculin. This was evidenced by the different methods of tuberculin test which were before the medical profession—the eye reaction, the skin reaction, the urethral reaction, the nasal reaction, etc. We urged at that time that if this were the truth, the discussion as to the methods of diagnosis which had been used were rather futile; that the one should be chosen which was the least dangerous, most ready of application, and most easily observed and controlled.

A year later we called attention to the necessity for getting away from the qualitative studies of this method of diagnosis, and reducing it to some definite quantitative basis, and offered, in an article published in the "Journal of Medical Research,"† a definite quantitative plan to be carried out in this test.

We do not wish to be accused of entering at this time into a discussion of the value of the cutaneous reaction in diagnosis. We feel that it is a point of evidence in diagnosis to be put upon the same basis as the clinical thermometer, chest examination, afternoon tiredness, clinical history, and all other contributory evidence of diagnosis to the clinical picture caused by the tubercle bacillus. It has, however, an especial value in ruling out certain cases as non-tuberculous.

At the present time, however, we feel that on the definite quantitative plan, such as we have suggested, it is possible to determine the exact response which the body suffering from tuberculosis will make to definite quantities of

* Proceedings of the National Association for the Study and Prevention of Tuberculosis, 1908, p. 96, White, W. C., discussion.

† White and Graham: *Jour. Medical Research*, vol. xx, No.3.

tuberculin introduced beneath the skin. And here it must be borne in mind that it is just as possible to obtain a constitutional reaction to tuberculin applied in the way of a skin test as it is when the tuberculin is introduced into the body subcutaneously. The following is an example of a fair number of cases which have come under our notice when the patients have been under the routine hospital supervision of regular temperature registration and personal control and will serve as a proof of this:

On October 8, 1909, Mr. L. was given a skin test on the left forearm, $\frac{1}{100}$ of a cubic centimeter of 100 per cent. O. T. being applied. Within an hour reaction had begun, and in twenty-four the reaction was marked; in forty-eight hours very marked, diminishing somewhat in seventy-two hours, the areola remaining, however, for two weeks. At the point of inoculation there was marked swelling, heat, and redness, and very noticeable redness, swelling and tenderness of the lymphatic leading from the site of inoculation as far up as the axilla. For four weeks previous to the skin test the temperature had been normal, except on two or three occasions when it reached 99° F. On October 9th at 12:00, the temperature was 100.5°; at 4:00, 101°, and at 8:00, 100.5°. On October 10th, at 12:00, it was 99°, at 4:00, 100°, and at 8:00, 99° F. The following day (October 11th) the temperature was normal. On October 9th the patient complained of weakness, headache, and general malaise. In fact, there was a good deal of prostration. The following day (October 10th) he complained of weakness, but the headache was gone and there was only slight general malaise.

A year ago, at the Association of American Physicians, we read a paper* laying down a law of partition of dosage based upon the quantitative basis of skin-cell reaction. We regret that this was published hastily as a paper, instead of what should have been termed a preliminary note. Certain of the figures given at that time we have since determined to be at fault. At the same time we have proved to our satisfaction that the principle contained in that paper is correct, and we wish now to exhibit the result of a year's work, which will give the correct partition doses based upon the determination of the minimal cutaneous reaction to definite quantities of tuberculin.

We wish first to call attention to certain requisite points which must be carried out in the application of the skin test. The tuberculin must undoubtedly be a solution of tuberculin poison, such as is contained in the old tuberculin or in the filtrate. Suspension of tubercle bacilli such as are contained in the bacillen emulsion and in the T. R. are not permissible. The use of a solution of tuberculin is necessary to render absorption of the poison as

* White, Graham, and Van Norman, *Jour. Medical Research*, vol. xxi, No. 2.

easy as possible. Suspension of bacilli containing, as they do, clumps of fair comparative size with the poison still in the bacillary body do not permit of ready absorption by the lymphatics, which is necessary, as will be shown later.

The choice of situation of the application of the preliminary skin test is important. Many factors enter into this choice. First, the thickness of the cuticle; second, the number and distribution of lymphatics; third, the readiness with which the patient can keep the part at rest until absorption of the solution has occurred; fourth, the absence of hair-follicles. The thickness of the cuticle varies greatly in different parts of the body, and requires, as we have frequently shown in our work, a different depth of scarification to produce the requisites for uniform absorption. We have found that the inner side of the forearm has, as a rule, a thin cuticular layer which gives uniform results with approximately the same scarification. The distribution of lymphatics on the forearm in the above location is also fairly uniform, and the channels of lymphatic drainage fairly straight in their course, so that in placing tests below one another, it is possible, by shifting the lower test to the right or to the left, to obtain a different draining channel than that which is used in the upper test. In the matter of keeping the part at rest to allow as complete absorption as possible, no part answers so well as the forearm, which is under the patient's control and not under the necessity of being used, and can be kept in a horizontal position more easily than any other part of the body. To fulfil all the conditions outlined, we have chosen the forearm.

Preceding the application of the test, to remove any chances of infection, fat and scurf that may have gathered upon the skin, it is best to wipe off the seat of application with alcohol, followed by ether.

The scarification we consider a point of very great importance. The former method, in which we followed Pirquet, was to scarify through the drop of solution. This was found to give various results in the same patient at the same and different times. In our present method we scarify the cleansed skin with such force as to just pierce the upper layer of the cuticle and elicit a punctate spot measuring two millimeters in diameter, the base of which shows bright pink color. This pink sometimes may not appear for a second or two after the scarification. It can be made deeper, if necessary to accomplish the desired result, by waiting a few seconds and watching for the pink appearance. It is necessary not to draw the least drop of blood.

Objections have frequently been raised to the use of the Pirquet scarifier; reasons being advanced in favor of needles and lancets with which are made longitudinal slits in the skin of deeper grade than that obtained by the Pirquet

scarifier. With none of these, however, can we agree, as it is possible only with the blunt-pointed Pirquet scarifier to obtain a depth and size of scarification which can be readily measured and which will underlie uniformly the measured drop of fluid which we use in this test.

The color-index in the way indicated here can be followed more accurately than in any other way in which we have tried. We have found that only with this color-index can we be sure of having gone the requisite depth at the same and at different times in the same and in different patients. We formerly gave a definite number of twirls with the Pirquet scarifier, but it was found impossible to control this procedure and get the requisite color in different patients on account of the difference in toughness and thickness of the cuticle. After having made the proper scarification, a drop measuring exactly $\frac{1}{100}$ of a cubic centimeter of tuberculin solution to be used is applied by a throttle pipette exactly over the point of scarification. This is then covered with a vaccine shield, kept in place by two strips of adhesive, and the patient directed to hold the arm in a horizontal position for at least an hour, so as to prevent flowing of the drop. These precautions are necessary because the essential thing in the tuberculin reaction is the absorption of the poison.

In the former method of application of this test most of our patients reacted to very much higher percentages of tuberculin than is found with the present method—varying from 1 per cent. to 100 per cent. of pure old tuberculin. The majority of them reacted to $\frac{1}{100}$ of a cubic centimeter of 12.5 per cent. of pure old tuberculin. With the present method, when we are sure that all conditions for ready absorption have been fulfiled, the majority of patients react to 1 per cent., very few require as high solution as 25 per cent.; very few of them give a minimal cutaneous reaction to a solution higher than 5 per cent., and many of them react to solutions lower than 1 per cent. A fair number give minimal cutaneous reaction to solutions as low as 0.1 per cent.

We would call a minimal cutaneous reaction one that gives a redness and swelling measuring four to six millimeters in diameter within seventy-two hours. It will be objected by many that this is reducing the cutaneous reaction below the point of usefulness, but the longer we work with cutaneous reactions, the more convinced we become of its absolute specificity and delicate nature, and feel that it is only when one takes into cognizance under the above precautions this delicacy of reaction in determinations that one can reach the usefulness to which this method can be put.

We usually start now with a solution of 1 per cent. of old tuberculin, because this is the solution to which many of the patients give minimal cutaneous reaction. If 1 per cent. is found to be too high, as it is in a fair number of

cases, one can judge by the size of reaction, and choose the next best solution to try, reducing it to 0.50, 0.25, or 0.1, as indicated by the size of the reaction. If no reaction occurs to 1 per cent. solution, one can go to higher solutions—2, 3, 4, and 10 per cent., as may be indicated by the reaction to the slowly increasing strength of the solution, letting four days elapse between the applications. If time is a factor in determining the beginning dose of treatment, one can apply two solutions at the same time on the same arm. We frequently use 1 per cent. and 0.25 per cent. for a first test when time is a factor.

It has been objected by many that occasionally one finds in obtaining reactions to two solutions of different strengths at the same time that the area of reaction is greater around the point of application of lesser strength than around the point of application of greater strength. This may be true under certain conditions: First, that the weaker solution is applied at a point more proximal than the application of the stronger solution; and, second, that the application of the proximal weaker solution be along the same lymphatic channel as the more distal stronger solution. Under these conditions, as will readily be seen by the following photograph (No. I), the lower stronger solution has drained directly through the lymphatic, which it has definitely reddened, to the point of application of the weaker solution higher up in the same channel, giving a much larger area to the solution above, and then is carried through the lymphatic channel above this, which it has perceptibly reddened in its course. It will also be noticed that while the area of redness is greater around the application of the weaker solution, yet the central ulcerated point is much more definite at the site of the stronger solution.

The accompanying photograph (No. II) shows the result of two tests given at the same time in the correct way; that is, the weaker solution distal and the stronger solution proximal. The solutions used in No. 2. were $6\frac{1}{4}$ per cent. (distal) and 12.5 per cent. (proximal) O. T., and it will be seen that the area of reaction in the proximal solution is about twice the size of the area of reaction of the distal weaker solution. A corresponding result is seen in Photograph No. III, where 0.1 per cent and 0.25 per cent. O. T. were used.

So far as we have been able to find, the question of the importance of the lymphatics and the redness of the lymphatic channels produced by the application of the tuberculin skin test has never before been brought to the attention of the profession.

The next two photographs (No. IV), which have been taken directly from the arms after the applications of varying strengths of solution, will at once convey the truth of the statement that the lymphatic vessels bear a very striking and important part in this reaction, and will give the proof of the necessity

which is required for allowing for the period of more complete absorption of the poison from the point of application; and we would emphasize again that when two applications of tuberculin are made at the same time, the greatest care must be exercised not to place them in such a way as to allow drainage from them along the same lymphatic channel. This undoubtedly explains the variations which are found in the published photographs of Pirquet and others to different solutions.

We feel that the question of lymphatic distribution is a point which must be borne very strictly in mind in the treatment with tuberculin, the focal reaction around the tuberculous lesion being a requisite factor in treatment. The dose in treatment may be so given as to drain along the lymphatic into the site of the lesion, and thus obtain the benign influence of focal reaction. This would apply to glands, sinuses, bone lesions, and lupus.

We would emphasize also this second point, that in making two applications at the same time, the precautions must always be observed of placing the weaker solution at a point more distal than the stronger solution. We feel that only under the most pressing necessity should two tests upon which a dosage is to be determined ever be given at the same time.

When these precautions are observed in the application of the test to determine the minimal cutaneous reaction, we feel that results directly comparable with our own will be obtained.

We must, however, further indicate certain precautions that are necessary to observe in determining the minimal cutaneous reaction, from certain phenomena which have arisen which evidence the vigor of the cells of the body of the patient to whom the test is applied. We formerly thought that the vigor of the body-cells had much to do with the intensity of reaction, having found certain patients who had a lung lesion on physical examination of a first or second stage Turban, with tubercle bacilli in the sputum, who did not react to 100 per cent. old tuberculin given repeatedly, but who later reacted to a lower percentage after much improvement in general condition and body weight had taken place. This we afterwards determined to depend almost, if not wholly, on the depth of scarification, and when we applied the above outlined method of deep scarification, being sure to pierce the cuticle, these cases were reduced to a minimal cutaneous reaction of $\frac{1}{100}$ of a cubic centimeter of a varying percentage from 0.1 per cent. to 10 per cent. In fact, so striking has been this in the reaction of patients when the precaution of depth of scarification is taken, that we have come to look upon the scarification as the most important part of the technic.

It has been urged that a part of the skin which had formerly responded to an

application of tuberculin by the signs of redness, tenderness, and swelling will not react to a later application of tuberculin within a given period of time. This, however, we have proved to be a fallacy, as the same spot will react again to further applications of the same strength of tuberculin or a lower strength of tuberculin within at least two months of the time of the application of the test, which is shown by the accompanying photograph (No. V).

A caution must here be added upon the point of persistence of the sensitiveness to the same strength of tuberculin application. Many patients in the hospital who have received tuberculin regularly for a year or more under the method outlined have not changed in their sensitiveness to tuberculin used as a skin test.

We feel that there has been in the past a grave mistake committed in mixing susceptibility to tuberculin with the sensitiveness which is produced by the growth of the tubercle bacilli in the living body. All that can be said at the present time is that sensitiveness of the cells of the body to tuberculin is due to the growth of the tubercle bacilli in the living human body, and we have not yet been able to secure undoubted evidence that any increase of sensitiveness has been aroused in the body, in which the tubercle bacilli have grown, by the use of tuberculin. We will discuss this point in a later paragraph in this paper, but wish to call attention to it at the present time.

Cases which have formerly been described as being hypersensitive to tuberculin, we feel can all be explained upon the basis of the degree of sensitiveness which is present in the first instance, as indicated by our cases which react to percentages as low as 0.1. Almost any of the doses of old tuberculin formerly given would have produced some degree of reaction in these patients, but their sensitiveness having been determined by our method, it is possible to give such minimal doses as to avoid the reaction produced in these cases when treated by the former method of administration. The same argument is applicable to those cases of so-called hypersensitiveness after subcutaneous administration of tuberculin for constitutional reaction in diagnosis.

We have seen certain cases in which we have felt that acute tonsillitis increased the sensitiveness to tuberculin applied as a skin test, but of this we have not seen a sufficient number of cases to arrive at a conclusion, and merely offer it here as a suggestion.

In discussing the therapy of tuberculin reaction it is necessary to bear in mind three factors: the cells, the serum, and the tuberculin poison, and the interaction of each of these three factors upon two others of the group. All these relations we do not pretend to have worked out, but, as a proof of the influence serum must have, it may be well to interject here a note on certain

studies which we have carried out in relation to the neutralization power of serum on tuberculin in the cutaneous test. These studes will be found in the *Journal of Medical Research*.* In this paper we found one group of patients in whom the serum added to tuberculin was able to augment the reaction. In studying this group during the past year we have found that the serum of one patient is able to produce a cutaneous reaction in patients who react to 0.1 per cent. O. T., as the accompanying photograph (No. VI) will demonstrate. We were able to obtain the reaction in two cases: first, in the patient whose serum was used and whose minimal cutaneous reaction is 0.5 per cent.—that is, this patient reacted to his own serum; second, in a patient whose minimal cutaneous reaction is 0.1 per cent. The reaction in this patient is shown in the accompanying photograph (No. VI).

Just what the bearing of this is and how frequently it occurs we are not prepared at this time to say, but in this patient it had no relation to tuberculin administration either for treatment or for skin testing, and the only factor that we were able to determine which might have a bearing was that the patient at the time had a mild temperature; but in trying the serum of other advanced cases with temperature there was no reaction produced even on the skin of those patients who were most acutely sensitive to tuberculin.

Having stated these precautions and preliminary remarks, we can now take up the question of therapeutic doses of tuberculin which can be given on the minimal cutaneous reaction basis. It would probably be best here to insert a table (Table I) of quantities of tuberculin contained in the various dilutions of

TABLE I.—QUANTITY OF TUBERCULIN (O. T.) USED IN CUTANEOUS TEST OF VON PIRQUET

Dose	Concentration of Solution	Quantity of Tuberculin by Weight Applied
0.01 c.c.	0.10 per cent.	0.010 mgm. O.T.
0.01 "	0.25 " "	0.025 " "
0.01 "	0.50 " "	0.050 " "
0.01 "	1.00 " "	0.100 " "
0.01 "	5.00 " "	0.500 " "
0.01 "	10.00 " "	1.000 " "
0.01 "	20.00 " "	2.000 " "
0.01 "	50.00 " "	5.000 " "
0.01 "	100.00 " "	10.000 " "

tuberculin. It will be seen that the most important point in determining the dose to be given for therapeusis is the use of $\frac{1}{100}$ of a cubic centimeter of tuberculin in the skin test, this giving us a definite quantity of tuberculin upon which

*White and Graham, *Jour. Medical Research*, vol. xxi, No. 2.

to base our partition dose in the matter of treatment. As outlined in our former paper, we suggested that there was a definite relation between the quantity of tuberculin which produced a certain amount of reaction on the skin and the amount of tuberculin which would produce varying grades of reaction from a slight local to a maximum constitutional and focal reaction in the individual.

In the former paper we made the statement that "one-fifteenth of the amount of O. T. which when applied to the skin by our method produced the minimal cutaneous reaction would, when given subcutaneously, produce both local and constitutional reactions; that one-thirtieth of the same amount subcutaneously would produce local reaction without constitutional. Later work has shown that one-fiftieth of the minimal cutaneous reaction dose will produce neither local nor constitutional reactions when given subcutaneously." These figures we have at the present time to state were not correct, but this was mainly due to the fallacy of our method in applying the skin test, which we have since corrected, and outlined in the first part of this paper.

The past year's work has determined, however, that the quantity of tuberculin contained in $\frac{1}{1000}$ of a cubic centimeter of a definite solution of tuberculin which will produce exactly the minimal cutaneous reaction, which we have arbitrarily called four to six millimeters' redness and swelling at the site of application of the test, will produce, when given underneath the skin, an area of redness, tenderness, and swelling measuring from two to five centimeters. From observation on a very few cases it would seem that if this dose is increased ten times, it will produce the symptoms of constitutional reaction, and if it be reduced in amount to one-tenth, it will be below the amount which will produce even a local reaction at the site of inoculation. We have, however, not yet been able to verify these last two figures on a sufficient number of cases.

In determining the dose on the skin test, and to show how sensitive the individual biological basis upon which it is based is, and how important are the measurements which we have outlined in millimeters, we would cite an individual case, of which type there are a great many.

Mr. A. reacted to a 5 per cent. solution of O. T., giving an area of redness of 13 by 9 millimeters in forty-eight hours. Four days later 3 per cent. was given, causing a reaction of 9 by 8 millimeters in forty-eight hours. Five days later 2 per cent. was given, the resulting reaction being 8 by 7 millimeters in forty-eight hours. Four days later 1 per cent. was given, the reaction being 7 by 5 millimeters in forty-eight hours. Four days later 0.25 per cent. was given. In twenty-four hours there was slight redness of 2 millimeters at the point of inoculation, but this had faded in forty-eight and seventy-two hours. Four days later 0.5 per cent. was given, the resulting reaction being 4 millimeters in forty-eight hours.

It will be seen that, in order to make this arbitrary law applicable, it is absolutely necessary to obtain that quantity of tuberculin which will produce exactly a minimal cutaneous reaction of four to six millimeters in order to say that the same quantity introduced under the skin will produce redness of two to five centimeters.

Much of our orignial discrepancy came from guessing at the quantity of tuberculin to be given therapeutically on the basis of a result from two solutions. An example would be as follows: A case would be given 5 per cent. as the initial skin test, the reaction being about 1 centimeter. Five days later 0.5 per cent. would be given, with no reaction. Formerly we would have guessed the basis to be 3 per cent., whereas, there would likely have been a reaction of 4 or 5 millimeters to a 1 per cent. solution.

It is necessary, in determining the minimal cutaneous reaction, to watch the reaction at the end of twenty-four, forty-eight, and seventy-two hours. Oftentimes at the end of twenty-four hours there is an outer ring of faint pinkness around the red reaction. This pink often fades at the end of forty-eight hours, and it must not be taken into account in the measurement of the minimal reaction (central redness). Occasionally the reaction, as has been observed by many other writers, is delayed at least forty-eight hours, and it may be as late as seventy-two, or even later. Our method of registering the minimal cutaneous reaction can be seen by the following table:

TABLE II.—SKIN TESTS

Name	Date	Percentage of Tuberculin	Result			
			In 24 Hours	In 48 Hours	In 72 Hours	
Miss E.	March 7, '10	1.00	.5 × .5 sl.	.5 × .5 m.	.5 × .5 v. sl.	M. C. R.
" J.	" 7, '10	0.50	.5 × .4 m.	.2 sl.	—	M. C. R.
Mr. A.	" 7, '10	0.25	.6 × .6 m.	.4 × .4 +	.4 × .4 v. sl.	M. C. R.
Mrs. B.	" 7, '10	0.10	.5 × .3 m.	.6 × .4 m.	.5 × .4 sl.	M. C. R.
Mr. C.	" 15, '10	1.00	.7 × .7 m.	.5 × .5 +	.5 × .5 sl.	M. C. R.
"	" 20, '10	0.50	.5 × .4 +	.4 × .4 +	.4 × .4 m.	= 0.5%
"	" 25, '10	0.25	—	—	—	
Mrs. D.	" 15, '10	2.00	1.3 × .5 +	1.5 × .1 +	1 × .8 m.	
"	" 20, '10	1.00	.9 × .6 +	1.3 × .8 m.	1 × .7 sl.	M. C. R.
"	" 25, '10	0.50	.6 × .6 m.	.4 × .4 +	.4 × .4 sl.	= 0.5%
"	" 30, '10	0.25	—	—	—	

Figures = diameter (in centimeters) of areola of reaction.
v. sl. = very slight
sl. = slight.
m. = moderate
\+ = marked
} redness of areola.
M. C. R. = Minimal Cutaneous Reaction.

Having determined the dose of tuberculin which will produce underneath the skin an area of redness and swelling measuring two to five centimeters, which is, as stated above, the quantity of tuberculin which is contained in $\frac{1}{100}$ of a cubic centimeter of the solution of tuberculin which produces a minimal cutaneous reaction measuring four to six millimeters, we next must approach the question of what is the desirable therapeutic dose, and the method of procedure for future dosage.

The first question that may fairly be asked is if we have proof that tuberculin is a valuable therapeutic agent. This can undoubtedly be given a positive answer, as every one who has used tuberculin must have concluded from its action on bone and gland sinuses, localized tuberculous lesions in glands and various organs (especially would we call attention to certain corneal ulcers), and to the application of tuberculin to lupus. These give, without question, a positive answer to the value of tuberculin in treatment.

The next point to be determined is what dose of tuberculin is the valuable dose. There has been a marked variance of opinion between the German and English investigators in this matter. The German investigators have recently been tending toward the exhibition of doses large enough to produce constitutional reaction. The English observers have tended toward exceedingly small doses, guided in their therapy by the opsonic-index method, as indicated by Wright. In this country the English method of small doses has mainly been followed in an outline laid down by Trudeau and Brown, of Saranac Lake. It must have struck most observers who formerly gave tuberculin subcutaneously that patients seemed to improve very markedly in general feeling and in diminution of sputum, and often of fever, after a constitutional reaction such as was obtained in the former method of diagnostic administration of tuberculin.

Too much importance cannot be laid upon Dr. Trudeau's experiments* in the tuberculous eyes of rabbits which were given tuberculin in sufficient doses to produce focal reaction, and which local eye lesion made marked improvement following the reaction. Saathoff† has recently called attention to this fact in a paper from Müller's clinic, in which he was able to watch a corneal lesion improve steadily after the repeated focal reactions produced by the tuberculin administration. Dr. Trudeau‡ remarks, in a paper published a year ago, that "improvement in the lesion may depend on the influence of these mild reactions, but in considering the advisability of utilizing mild, general, and

* Trudeau, E. L., Tr. Assn. Am. Phys., May 24, 1892.
† Saathoff, *Münch. med. Woch.*, No. 40, 1909.
‡ E. L. Trudeau, *Jour. Amer. Med. Assoc.*, lii, January 23, 1909.

focal reactions as a feature of treatment, we must not forget that we have no means of controlling the severity of these reactions and that violent reactions are not without danger." We have been struck with the apparent uselessness of giving small doses of tuberculin in pulmonary and gland tuberculosis, which type of case has mainly been under our supervision.

For two years we followed the method of administration of tuberculin which gave small doses repeated frequently, and we have at the present time under our care patients who have been receiving tuberculin in the hospital for a period of three years or more. During the first two years of their stay in the hospital they received tuberculin by the small, frequently repeated doses, and apparently made no marked improvement other than would be looked for by hygienic conditions. However, during the past year, when they have been treated with doses which produce mild reactions below the fever line, they have made great and noticeable strides; while in the months previous they had been practically at a standstill. It may be objected to this, of course, that tuberculosis takes a wave-like course, but we feel that this is not a valid objection when the condition has steadily improved, with an increased feeling of well-being and diminution of sputum after each local reaction produced by the tuberculin dose. In some of these cases the sputum has diminished to one-half or one-third of the former quantity.

It may be best here, without further discussion, to say that we believe, first, in doses that will produce mild reactions below the fever line in all cases of tuberculosis that admit of tuberculin as a therapeutic agent; second, that the thing to be obtained is the reaction of the cells and not the tolerance to the tuberculin poison. We have come to look arbitrarily upon the reaction of greatest good as one which will produce underneath the skin an area of redness, tenderness, and swelling of approximately two to five centimeters in diameter at the site of injection. We have not seen a single case to shake our faith in this basis of dosage in the administration of over 1000 injections of tuberculin for therapy based directly upon the minimal cutaneous reaction.

The next point of importance is the spacing of the dosage. 'We have found that tolerance to tuberculin can readily be established if the doses are given in the Saranac method, three or four days apart, and in increasing doses. On the other hand, we have found that, as a rule, when once the dose which will produce the above degree of redness at the site of injection based upon the minimal cutaneous reaction has been determined, that patients retain, as a rule, the same degree of reaction for periods reaching as high as nine months. The two cases following will show this point.

TABLE III.—SHOWING UNIFORMITY OF LOCAL REACTION FROM SAME DOSE OF TUBERCULIN

Date	Tuberculin	Local Redness	Local Tenderness	Local Swelling	Local Redness	Local Tenderness	Local Swelling	Constitutional Symptoms
	O. T.	In Twenty-four Hours			In Forty-eight Hours			
Aug. 15, '09	.0002	2 cm. sl.	sl.	sl.	3 cm. sl.	sl.	sl.	—
" 25, '09	.0002	2 " sl.	sl.	v. sl.	5 " +	+	sl.	—
Sept. 4, '09	.0002	3 " sl.	sl.	sl.	4 " sl.	sl.	sl.	—
" 14, '09	.0002	3 " sl.	sl.	sl.	3 " m.	sl.	sl.	—
" 24, '09	.0002	2 " sl.	sl.	sl.	4 " sl.	sl.	sl.	—
Oct. 4, '09	.0002	2 " m.	sl.	sl.	3 " m.	sl.	sl.	—
" 14, '09	.0002	2 " m.	sl.	sl.	4 " m.	sl.	m.	—
" 24, '09	.0002	2 " sl.	sl.	sl.	2.5 " sl.	sl.	sl.	—

Figures in column Local Redness = diameter (in centimeters) of redness.
v. sl. = very slight.
sl. = slight.
m. = moderate.
+ = marked.

TABLE IV.—SHOWING UNIFORMITY OF LOCAL REACTION FROM SAME DOSE OF TUBERCULIN DURING EIGHT MONTHS

Date	Tuberculin	Local Redness	Local Tenderness	Local Swelling	Local Redness	Local Tenderness	Local Swelling	Constitutional Symptoms
	O. T.	In Twenty-four Hours			In Forty-eight Hours			
Aug. 3 '09	.0001	2.5 cm. m.	m.	sl.	2.5 cm. m.	m.	sl.	—
" 25, '09	.0001	2.5 cm. m.	m.	sl.	2.5 cm. m.	m.	sl.	—
Sept. 27, '09	.00015	4 " +	+	m.	4 " +	+	m.	—
Oct. 28, '09	.0001	2.5 " m.	m.	sl.	2.5 " m.	m.	m.	—
Nov. 8, '09	.0001	3 " sl.	sl.	sl.	3 " m.	m.	sl.	—
" 18, '09	.0001	2 " m.	m.	m.	5 " sl.	sl.	sl.	—
" 29, '09	.0001	3 " m.	m.	m.	3 " sl.	sl.	sl.	—
Jan. 29, '10	.0001	3 " m.	+	+	6 " m.	m.	+	—
Feb. 12, '10	.0001	5 " m.	+	m.	3 " m.	+	m.	—
" 28, '10	.0001	3 " m.	+	m.	3 " m.	+	m.	—
March 14, '10	.0001	3 " sl.	m.	m.	4 " m.	m.	m.	—
Apr. 4, '10	.0001	3×2" sl.	sl.	m.	5×4" +	sl.	m.	—

Figures in column Local Redness = diameter (in centimeters) of redness.
sl. = slight.
m. = moderate.
+ = marked.

Consequently, having determined to our own satisfaction that patients do better when they retain their reaction to tuberculin, we feel that it is infinitely better to continue the same dose with an interval of fourteen days between doses. A word of caution must be added here that a skin test, with the readiness with which tuberculin is absorbed, is equivalent to a therapeutic dose of tuberculin, and if the first dose of tuberculin for therapy be given within a few days after the exhibition of a skin test, the resulting local reaction at the point of injection is apt to be greater than if the injection of the therapeutic dose is delayed fourteen days. The choice of the site of injection of the therapeutic dose of tuberculin is not apparently a matter of great importance, as we have determined without failure up to the present time that the same dose of tuberculin given in either arm, leg, or trunk produces exactly the same degree of redness and tenderness.

A word or two here might not be amiss in reference to the technic of administering tuberculin. We have already mentioned that whether the tuberculin be given in the legs, arms, or trunk, one always gets approximately the same amount of redness and tenderness with the same dosage. As a rule, however, in starting tuberculin treatment, we begin by using the arms, each arm being used alternately. The tuberculin is administered in the arm between the shoulder and elbow, posterior aspect; that is, over the triceps muscle. It should be given just under the skin, and not injected deeply. The skin is cleansed with alcohol, and is then pinched up, ready for the plunge of the needle. The needle is inserted with the bevel-edged opening pointing outward toward the skin surface. In order to give the tuberculin subcutaneously, the needle is entered through the skin at a very acute angle, and it is advisable to insert the needle up to the hilt, so that when the needle is withdrawn, no tuberculin will exude through the opening. The reason for keeping the bevel edge of the needle outward is that the tuberculin when leaving the needle may enter the cutaneous tissue, and not the deeper tissues, for if the tuberculin be injected deeply into the tissues, the resulting local reaction may be much less than when the tuberculin is given just under the skin; and to a certain extent one judges the dosage of the tuberculin by the amount of local reaction. After using the arms for a few injections, one may give the tuberculin in the thighs, back, chest, or abdominal wall.

It may now be asked what advantage there is in determining a dose of tuberculin on the basis of a minimal cutaneous reaction if one does not desire to obtain the reaction produced by tuberculin of the degree indicated in this paper. The method suggested here is not directly applicable save to those who believe in local reaction. At the same time, it will allow the determination of a

perfectly safe dose, varying at least 100 per cent. in quantity. According to our studies, we have determined that in tuberculin dosage there is, in individuals, a variation of the primary dose from at least 0.000005 to 0.0005 milligram of tuberculin, to produce the same amount of reaction; that is, this method is capable of giving us at once an initial dose of tuberculin varying from 0.000005 to 0.0005 milligrams O. T.—a dose varying 100 times in amount from the smallest to the largest. This forms then a basis for dosage vastly in advance of the former method, when all patients were given doses of tuberculin of minimal amount in gradually increasing quantities until the point of reaction was reached. In this way it is possible to determine a dose for each case which will produce exactly the same degree of local reaction in all individuals.

TABLE V.—SHOWING RELATION BETWEEN MINIMAL CUTANEOUS REACTION AND THERAPEUTIC DOSE OF TUBERCULIN

Minimal Cutaneous Reaction Per Cent. O. T.	Therapeutic Dose Milligrams O. T.
0.05	.000005
0.10	.00001
0.25	.000025
0.50	.00005
0.75	.000075
1.00	.0001
2.00	.0002
3.00	.0003
4.00	.0004
5.00	.0005
6.00	.0006
7.00	.0007
8.00	.0008
9.00	.0009
10.00	.001

Instead of taking, as in former instances, three, four, or five months to reach a dose such as is indicated here, it is possible to reach it within three week's time, so that if there were no gain in the reaction, at least there is a great gain in the patient arriving at the individual dose which the patient can tolerate. However, we feel that the greatest gain comes in determining the quantity of tuberculin which will give a mild reaction in every individual, and it is only when we get a dose of tuberculin which will produce these mild reactions that we can hope for beneficial results of a curative nature.

We feel that we have offered for the first time in therapy a specific, individual, biological test for therapeutic doses which is, of course, the goal to be aimed at in all therapeutic measures. In other words, instead of giving a dose of a drug which is known to produce certain physiological effect, in a small number of individuals it is possible in this way to give exactly the dose of

the drug which is best suited to each individual, and this must, in future, be the basis of rational therapeutics.

We are unfamiliar at this time with the causative factors which vary the sensitiveness of the body-cells to tuberculin, but we would here add a closing caution, that if, sometimes, during tuberculin therapy, the sensitiveness of the body to the tuberculin changes, it is best to determine the minimal cutaneous reaction before giving another therapeutic dose, and in this way it will be possible to keep the body at about the same reaction to therapeutic doses of tuberculin.

We have found that as a routine practice it is well to repeat the skin test for minimal cutaneous reaction every three months, but in pursuing this course, we have come to the conclusion that it is not the tuberculin administered which changes the susceptibility to this poison, but some deeper and more subtle influence.

CONCLUSIONS

First: it is just as possible to obtain a constitutional reaction from tuberculin placed on the skin as from tuberculin introduced beneath the skin. A tuberculin reaction, whether local, focal, or constitutional, must be looked upon as varying grades of the same response of the body to a varying quantity of tuberculin used.

Second: In the body in which tuberculosis has developed the degree of reaction of the surface cells to the poison contained in the different tuberculins depends upon—(*a*) Depth of scarification; (*b*) point of application; (*c*) distribution of lymphatics; (*d*) readiness of absorption; (*e*) exact amount of tuberculin used.

Third: At varying times the serum of individual cases contains a substance which is capable of producing a tuberculin cutaneous reaction in individuals who are very susceptible to tuberculin.

Fourth: The interval of dosage varies for the result desired. Less than seven days for tolerance and fourteen or more for retention of the reaction power of the cells.

Fifth: In the majority of patients, if the interval of doses be two weeks or more, the amount of local reaction from the same dose of tuberculin does not change in a period of many months.

Sixth: It is possible in determining the minimal cutaneous reaction to $\frac{1}{100}$ of a cubic centimeter of varying solutions of tuberculin, to state the exact amount of tuberculin which will produce a certain grade of reaction when introduced beneath the skin.

CUTANEOUS AND CONJUNCTIVAL TUBERCULIN TESTS IN PULMONARY TUBERCULOSIS— A REPORT OF 1000 CASES

By Louis Hamman, M.D., and Samuel Wolman, M.D.

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In the "Archives of Internal Medicine" for May, 1909, we reported the results of the conjunctival and cutaneous tuberculin tests in 500 patients. The present report deals with 1000 additional patients to whom these tests were administered, and who formed the unselected material of an ambulant clinic, the Phipps Dispensary of the Johns Hopkins Hospital. We made no change in the strength of the solutions used for the eye tests, nor in the technic of the skin tests, so that our last results are comparable with our earlier figures. We use one drop of a 1 per cent. solution of Koch's old tuberculin (human) in the left eye. In the event of no reaction we proceed with one drop of a 5 per cent. solution in the right eye. If this, too, produces no reaction, we refrain from further instillations, fearing the possible intensity of a reaction consequent upon a second instillation of tuberculin into an eye. Our fear is based on evidence, gathered accidentally, that a second instillation may give a positive and even a severe reaction, where a previous similar test gave a negative result. For the skin test we make a superficial incision in the skin of the forearm through a drop of old tuberculin—and, as control, through the untreated skin. In our first series we used simultaneously a 1 per cent., 5 per cent, and 20 per cent. solution for the cutaneous test, and found a comparison of the resulting reactions of no value for clinical diagnosis. We found also little difference in the reactions resulting from 20 per cent. O. T. and pure O. T. We, therefore, limited ourselves to undiluted tuberculin, in accordance with our published conclusion that only the negative skin reaction is of value in diagnosis. For further discussion of the technic and for contraindications to the eye test we refer to the previous report.

The 1000 cases are divided into six groups: non-tuberculous, doubtful, probable, incipient, moderately advanced, and far advanced. This division

is based on a careful clinical study, without reference to the result of the tests. As tuberculous, we included cases with tubercle bacilli in the sputum, and those affording only the strongest clinical evidence of tuberculosis. Cases concerning which clinical observers might have even a slight doubt have been ruthlessly placed in the doubtful class—which is, therefore, large—in order to elicit the more clearly the significance of the reactions. The probable group includes cases which most clinicians would regard as tuberculous, but for which the evidence is not absolutely convincing. The non-tuberculous group includes patients who are apparently well, or whose symptoms are demonstrably referable to some non-tuberculous cause. The non-tuberculous group numbers 188; the doubtful, 429; the probable, 78; the incipient, 35; the moderately advanced, 79; the far advanced, 191; making 305 tuberculous cases, of which 211, or 69 per cent., had tubercle bacilli in the sputum.

Table I shows the result of the tests in 188 non-tuberculous cases. Note that even in this group a positive cutaneous reaction is frequently obtained, but note particularly that a positive conjunctival reaction to 1 per cent. O. T. occurs in only 3 out of 186 cases.

Table II gives the results in 429 doubtful cases. Here a positive skin reaction is more frequent; a positive result to the 1 per cent. eye test is still comparatively infrequent.—in only 15 per cent.

Table III deals with the 78 probable cases. A negative skin reaction is infrequent, and a negative 1 per cent. conjunctival reaction is not as predominant as in the preceding groups.

Table IV deals with the 35 cases in the first stage of pulmonary tuberculosis. The negative skin reactions are here scarce; a negative conjunctival reaction to the 1 per cent. solution occurs in only 31 per cent.

Table V presents the 79 cases in the second stage. Negative cutaneous tests are rare—negative conjunctival reactions, especially to the 1 per cent. solution, in 23 per cent.

Table VI deals with the 191 far-advanced cases. Here there is an increase in both the negative skin and eye reactions, owing to the well-known fact that the moribund, who are naturally in this group, often show no reacting power.

Table VII shows the data of Tables I to VI, condensed and stated in percentages. The results of the 5 per cent. eye test are based on the figures given in the above tables, and are estimated in the manner described in our first report. They represent what would have occurred had all the patients received an instillation of a 5 per cent. solution in one eye. The striking feature of the skin test is the large number of positive reactions—even 57 per cent. of the non-tuberculous group. Already in the doubtful group, the number of

positive reactions rises to 83 per cent. A mean between the figures of these two groups would represent about what we would expect to find in the average adult. It is clear that a positive skin reaction cannot be used as evidence of clinical tuberculosis. The next column, giving the results of the 1 per cent. eye test, is the most striking of the whole series. Only 1.6 per cent. of non-tuberculous cases gives a positive reaction to this test—a result almost identical with that obtained in our first series. But note that a negative reaction to this 1 per cent. solution by no means excludes clinically active tuberculosis. However, the 5 per cent. eye reaction is valuable in revealing some of those tuberculous cases which do not react even to the 1 per cent. solution. Unfortunately, a fair number of active cases do not react even to the 5 per cent. solution, and a somewhat larger number of the non-tuberculous cases do react than to the 1 per cent. Still the 5 per cent. solution is of some further help, and certainly more useful than the skin test, because it does not include nearly as many non-tuberculous individuals. By using a solution stronger than 5 per cent. we might capture the remaining tuberculous cases, but we would run the risk of obtaining too severe reactions. We have been fortunate to encounter in no case of the 1000 anything more than a temporary inflammation of the eye, but, judging from the severity of the reaction in a few of the cases, we fear that the employment of anything stronger than a 5 per cent. solution would produce regretable results. For the same reason we do not care to make our initial instillation stronger than 1 per cent. We emphasize here that we use a simple saline solution of Koch's old tuberculin, and not of any precipitated tuberculin. Preparations of the latter are stronger and give different results. In brief, then, this table shows that the positive reaction to the 1 per cent. eye test is extremely strong evidence that the case does not belong to the non-tuberculous group. A positive 5 per cent. reaction is also strong evidence in the same direction, while in the skin test it is a negative result alone which is of any clinical interest (moribund cases being, of course, excluded).

A study of the tests in only those cases with bacilli in the sputum does not show any material variation from the above figures, and the tables are therefore omitted.

Table X is given to show the relation between the skin and eye tests. Note that a large number of cases not reacting to the eye test react to the skin test. Evidently these two tests are not interchangeable, although they vary, roughly, in the same direction. Together they may afford more instruction than either can alone.

Table XV is designed for a study of the prognostic value of the skin and eye tests. It has been asserted by some that a strong reacting power in a patient

is auspicious, and by others that it is ominous. Our 300 tuberculous cases were classified upon entrance as being in a favorable or unfavorable condition, the classification being based upon a consideration of pulmonary findings and the patient's general condition. Note that the negative reactions to the 1 per cent. eye test constitute about the same percentage in each division—27 per cent. and 31 per cent. Also the + + + reactions to this test form 14 per cent. in each division. Among those marked unfavorable we know of 38 who died. In this group, too, the percentages are about the same. The + + + reactions seem a little more numerous, but we cannot base a conclusion on 38 cases. We have regrouped these 300 cases on the basis of the stage on admission, and find that here, too, the percentage figures are about the same in the three classes. We cannot, therefore, attach any prognostic value to the skin and eye tests. Nor does high reacting power in a patient give us any clue to his chances for recovery.

Summary: The agreement between our present figures and those of May, 1909, encourages us in drawing the following conclusions. The skin test has in adults a diagnostic value only when it is negative. A positive reaction to the 1 per cent. eye test (normal salt solution of untreated Koch's old tuberculin) occurs only rarely in clinically non-tuberculous individuals. Only a small number of cases reacting to the 5 per cent. eye test are clinically not tuberculous. We, therefore, attach considerable value to the eye tests, especially in checking up the examinations made in a large clinic. We attach no prognostic value to the tests. We must add, furthermore, our conviction that painstaking clinical examination must be made in every case.

TABLE I.—CUTANEOUS AND CONJUNCTIVAL TUBERCULIN REACTIONS IN 188 NON-TUBERCULOUS CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	5 per cent.
Negative reaction	80	183	121
+	92	1	8
+ +	12	1	1
+ + +	2	1	0
Not given	2	2	55

TABLE II.—CUTANEOUS AND CONJUNCTIVAL REACTIONS IN 429 DOUBTFUL TUBERCULOUS CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	5 per cent.
Negative reaction	73	365	205
+	278	38	33
+ +	65	16	26
+ + +	11	9	11
Test not given	2	1	91

TABLE III.—CUTANEOUS AND CONJUNCTIVAL TUBERCULIN REACTIONS IN 78 PROBABLY TUBERCULOUS CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	5 per cent.
Negative reaction	5	45	18
+	55	11	11
+ +	11	15	7
+ + +	7	7	3
Tests not given	0	0	6

TABLE IV.—CUTANEOUS AND CONJUNCTIVAL TUBERCULIN REACTIONS IN 35 INCIPIENT CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	5 per cent.
Negative reaction	2	11	4
+	22	12	5
+ +	8	8	
+ + +	2	4	

TABLE V.—CUTANEOUS AND CONJUNCTIVAL TUBERCULIN REACTIONS IN 79 MODERATELY ADVANCED CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	5 per cent.
Negative reaction	2	18	4
+	48	26	4
+ +	20	19	3
+ + +	8	16	1
Tests not given	1		

TABLE VI.—CUTANEOUS AND CONJUNCTIVAL TUBERCULIN REACTIONS IN 191 FAR-ADVANCED CASES

	Number of Skin Reactions	Number of Conjunctival Reactions	
		Instillation	
		First	Second
Strength of Tuberculin	Pure	1 per cent.	2 per cent.
Negative reaction	16	62	25
+	133	64	16
+ +	30	40	6
+ + +	10	23	3
Not given	2	2	14

TABLE VII.—TABLES I TO VI CONDENSED AND STATED IN PERCENTAGES

	Per Cent. of Skin Reactions		Per Cent. of Conjunctival Reactions			
Strength of tuberculin	Pure		1 per cent.		5 per cent.	
Degree of reaction	o	+	o	+	o	+
Non-tuberculous cases	43	57	98.4	1.6	92	8
Doubtfully tuberculous cases	17	83	85	15	64	36
Probably tuberculous cases	7	93	60	40	27	73
Incipient tuberculous cases	6	94	31	69	14	86
Moderately advanced tuberculous cases	3	97	23	77	8	92
Far-advanced tuberculous cases	8	92	33	67	17	83

TABLE X.—RELATION BETWEEN THE CUTANEOUS AND CONJUNCTIVAL REACTIONS

Conjunctival Reactions to First Instillation of 1 Per Cent.	Skin Reactions			
	Pure O. T.			
	Neg.	+	++	+++
Negative	166	418	80	16
680 cases	24%	62%	12%	2%
+	8	118	24	3
153 cases	5%	77%	15%	2%
++	3	60	25	9
97 cases	3%	64%	26%	9%
+++	2	29	18	11
60 cases	3%	48%	30%	18%

TABLE XV—A STUDY OF THE PROGNOSTIC VALUE OF THE TESTS IN 300 TUBERCULOUS CASES

	Per Cent. of Skin Reactions				Per Cent. of Conjunctival Reactions					
Strength of tuberculin	Pure				1 per cent.				5 per cent.	
Degree of reaction	0	+	++	+++	0	+	++	+++	0	+
116 favorable condition	5	60	28	7	27	32	27	14	11	89
181 unfavorable condition	9	71	14	6	31	36	19	14	14	86
38 died	10	75	10	5	26	33	20	20	13	87
34 incipient cases	6	65	23	6	31	34	23	12	14	86
77 moderately advanced	3	61	26	10	23	33	24	20	8	92
186 far advanced	8	70	16	6	33	34	21	12	17	83

GENERAL DISCUSSION IN CLINICAL SECTION

Dr. Charles L. Minor, Asheville: Mr. Chairman, personally, I find myself very closely in accord with Dr. Sachs' experience in this matter, and I believe that while there is great value in the von Pirquet test, the misconception of its use is leading to a good many diagnoses of tuberculosis which are not justified. A great many of the best authorities teach that the cutaneous

as a positive test is only useful under two years of age. Anybody considering Dr. Hamman's figures on this subject will be convinced of that matter. It has a value after that, but only negatively. I think the negative cutaneous test is a very valuable thing in excluding tuberculosis, but to rely upon the positive cutaneous test I think is going to lead to distinct mistakes in diagnosing as tuberculosis cases which are not such. I was surprised to find such a difference between such good observers as the gentlemen who reported here. The records from Ann Arbor surprised me a great deal. Personally, knowing Dr. Hamman's work, I shall possibly try to revise my views as to the possible danger and relative undesirability of the ocular test. My own impression has been that the subcutaneous test was distinctly the most valuable, and that the reason it is not so much utilized is because it is not as simple or as easy. But if anybody has once mastered the technic of it, I think they will then take to using the subcutaneous test.

Dr. W. C. White, Pittsburg: Dr. Wolman has done exactly what he has blamed other people for doing; that is, saying that a thing is impossible without having followed the method; and he could not have followed our method, because it has not been published yet, and so the results on which he bases his contention could not have much bearing here. In the 1200 tests we have not had a single failure. It is a very meager contention that we make at the present time, but I think the method can be developed into a test of wonderful value.

Dr. Theodore B. Sachs, Chicago: The papers of Dr. Hamman and Wolman on Tuberculin Tests and of Dr. Gordon on Relation of the Cutaneous to the Subcutaneous Tuberculin Tests are of great interest to me, as well as Quantitative Index to Tuberculin Dosage in Treatment by Dr. White; the last paper has an indirect relation to the same subject, and all three supplement each other. In the interpretation of some of the local tuberculin reactions as given by the first essayists and myself, there is no more diversity of views than could be expected at a time when the subject, in its various features, is still being comprehensively studied.

Due to the limited time allotted to each speaker I read at this session only a syllabus of my paper; the details and various data, to some of which the previous speaker alluded, will be found in the printed copy.

The question of the practical utility of the various local tuberculin tests is a very important one to the medical profession.

The introduction of the subcutaneous tuberculin test, made possible by the researches of Koch, marked a great advance in the difficult field of diagnosis of obscure tuberculosis cases. No objection is raised to the value of this

procedure in singling out tuberculous cattle, and, as far as the fight against cattle tuberculosis is concerned, the subcutaneous method is at present at the basis of the comprehensive systems introduced in various countries for the eradication of this very prevalent disease.

Objections have continued to a universal application of this test in human beings, for various reasons, of which the possibility of relighting a latent tuberculous focus is the most important one. The necessity of observing a case for some time previous and subsequent to the injection, and the marked systemic disturbance in some cases are also important conditions worthy of consideration in a universal application of a diagnostic measure.

With the use of small initial doses ($\frac{1}{5}$ or even $\frac{1}{10}$ milligram), gradually increased according to indication, the occurrence of general reactions of undesirable degree grew less frequent. A search for safer and less objectionable diagnostic procedures was continued, however, by numerous observers, and when the cutaneous test was announced two and a half years ago by von Pirquet, and the conjunctival test by Wolff-Eisner and Calmette, there was great jubilation in the medical profession, because it seemed that at last tests had been discovered, harmless as compared with the subcutaneous, and easily applicable by the general practitioner.

As in the case of any new medical procedure still under the searching light of extensive investigation, a diversity of views is to be settled later by the final conclusion based on extensive clinical, laboratory, and postmortem experience.

It is admitted that the cutaneous and conjunctival reaction is specific, and that their occurrence signifies the existence of a tuberculous focus, active or latent, somewhere in the body.

Von Pirquet, the originator of the cutaneous test, concludes, on the basis of his clinical and autopsy experience, that a positive cutaneous reaction in a child under two years of age points to the existence of an active process, as latent foci are rare at that age; he recommends the use of his test for diagnosis of tuberculosis in early life.

Wolff-Eisner and Calmette claim for the conjunctival reaction an advantage over the cutaneous, namely, its occurrence only in active cases of tuberculosis, the infrequency of the positive reaction in the "apparently healthy" class being used by Wolff-Eisner as one of the chief arguments. This very alluring distinction (very important, if proved) is still in need of conclusive corroborating data.

Of the factors determining the degree of the local tuberculin reaction, the following may be considered in this connection:

1. *The quantity of tuberculin in contact with the site of inoculation.* Is a

local tuberculin reaction possible with a smaller dose of tuberculin, in the presence of an active tuberculous process?

2. *The rapidity of absorption through conjunctiva and the further dilution of the tuberculin by secretion.* Is a smaller dose of tuberculin (but briefly in contact with the conjunctival membrane) sufficient to cause a reaction in the presence of an active focus while it fails in latent cases, etc.?

Applying the same line of thought to the cutaneous test, further investigation is necessary to determine if active cases respond more vigorously than latent to smaller doses of tuberculin at the site of inoculation.

So far only the specificity of the local tuberculin reactions is agreed upon; their correct interpretation is a possibility of the future.

The work of von Pirquet, Wolff-Eisner, and Calmette has opened a great field for further research, out of which finally may be evolved a safe and reliable method of diagnosis of obscure cases of tuberculosis.

Dr. Agnes C. Vietor, Boston: Mr. Chairman, I would like to ask the section a question in reference to something Dr. Minor said. He spoke about diagnoses being made on the cutaneous test alone.

Dr. Minor: In adults.

Dr. Vietor: I would like to ask the opinion of the section of such a case as one giving all the physical signs of incipient tuberculosis, and in which the cutaneous test has not been made, but in which the diagnosis has been made only on the physical signs; and then, after apparent cure of such a case, the cutaneous test has been made for verification, and has been negative. I would like to ask the impression of the section as to the interpretation of cases of that kind.

Dr. J. Ritter, Chicago: Mr. Chairman, I would like to say a few words in favor of the Moro test, which has apparently been ignored here. I think it is equally as applicable and as useful as the eye test. It has been my experience that if the skin is thoroughly sterilized, it is as reliable as the eye test. The trouble very often is that the application is made without previously preparing the skin. I am quite sure that in all these cases if you use the Moro test, so called, and sterilize the skin previously thoroughly, it is equally as good as the other.

Dr. A. W. Hewlett, Ann Arbor: Mr. Chairman, Dr. Minor spoke about the fallacy of making a diagnosis on the skin test. I would like to say a few words on the fallacy of making a diagnosis on the subcutaneous test in adults. I think that is a common mistake, and the point of this paper that I presented for Dr. Gordon is that the two have very much the same fallacy. In looking over the literature we found the record of 1000 injections in Viennese soldiers

made some years ago (at which time the dose did not exceed three milligrams), and we found from these records that of those who came from districts where tuberculosis was not prevalent, about 38 per cent. gave subcutaneous reactions, and of those who came from a district infected with tuberculosis, about 70 per cent. gave subcutaneous reactions, and, of course, the conclusion was drawn that the subcutaneous test alone was of little value in the diagnosis of clinical tuberculosis.

Dr. Charles L. Minor: In answer to the doctor I would say: "Nach alles, jeder Mann hat einbischen Tuberculose" was the dictum of Naegeli, and the fact that 38 per cent. of recruits reacted to the tuberculin test has no bearing on the reliability of that test. You have got to determine first the question of whether they are actively tuberculous or not. The present knowledge of the very great prevalence of tuberculosis in apparently healthy people will certainly not make an argument against that point.

Dr. C. Rayevsky: Mr. Chairman, I would like to state that we should not forget the danger of making a diagnosis on reaction of subcutaneous test without first making a careful physical examination: The tuberculin may act as a toxin generally, induce a rise of temperature and a feeling of discomfort, even in individuals not suffering from tuberculosis; a general reaction, therefore, without the demonstration of a focal one, is not always a proof of the presence of a tubercular process.

Dr. L. Rosenberg: Mr. Chairman, I doubt if there are very many experienced men using the subcutaneous test who hazard a diagnosis on that test alone. The patient is examined repeatedly; his sputum is examined repeatedly. The injudicious employment of this test is responsible for the disfavor in which it is still held in this country.

Chairman: I would like to say a word as to the way the whole subject impresses one who works in general or internal medicine. It occurs to me that we are dealing here with the same sort of problem that internal medical men have had to deal with in other diseases; that is, the difference between a certain diagnosis and a probability diagnosis. Now, in my opinion there is only one way of making an absolutely certain diagnosis of tuberculosis, and that is to demonstrate the tubercle bacillus in the body or in the sputum. If you can show the presence of the bacillus, you have absolute certain proof of the existence of tuberculosis; otherwise your diagnosis is a probability diagnosis, and it remains so until the bacillus is actually demonstrated. Now, in making a probability diagnosis we utilize all the methods at our disposal,—the methods of physical diagnosis, laboratory, the *x*-ray methods, the tuberculin tests,—and then having collected all the data we can, we use the very best

clinical judgment we can formulate from our previous experience with these various methods. It seems to me that is about the status at present, and there is great variation in opinion as to the relative value of these individual tests.

Dr. A. C. Vietor : My question has not exactly been answered, and I will put the question in another way. Would the members who have had experience with the cutaneous test expect to find the reaction modified by a symptomatic cure of an incipient tuberculosis—I mean cure of objective as well as subjective signs?

THE DIAGNOSIS OF TUBERCULOSIS OF THE BRONCHIAL GLANDS

By Henry Farnum Stoll, M.D.
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In view of the fact that pulmonary tuberculosis is almost always secondary to tuberculosis of the bronchial glands, and as we know that months, even years, may elapse before the lung becomes involved, it is surprising that the diagnosis of bronchial gland tuberculosis has not received more attention.

Except for a short paper, presented by Gray [1] two years ago, which dealt chiefly with vertebral bronchophony, the subject has never been discussed by this Society; nor was it considered at the recent International Congress of Tuberculosis. Yet disease of the glands frequently gives symptoms, and often physical signs, months before the lung is invaded.

The lymph-nodes, known as the tracheobronchial or mediastinal glands, are divided into three groups. The tracheal glands, which surround the trachea, are in relation with the superior vena cava, the pneumogastric, and recurrent laryngeal nerves. The group situated at the bifurcation of the trachea is in contact with the pneumogastric nerve, and also with the pericardium anteriorly, and the esophagus posteriorly. The pulmonary vessels are below, the spinal column adjacent, vessels and nerves on the right. The hilus glands extend along the bronchi to the lungs, and are in relation with the branches of the bronchial and pulmonary vessels.

The glands at the bifurcation of the trachea are usually the first to be diseased, Wollstein [2] finding the gland adjacent to the right bronchus the seat of the primary lesion in 74 per cent. of her cases. The individual glands rarely exceed an inch in diameter, and are usually smaller.

As the trachea extends downward it inclines to the right, so that at its bifurcation at the level of the fourth or fifth dorsal vertebra it is near the right border of the vertebral column.

It is unnecessary in this paper to take up the pathology of tuberculous glands. Sufficient to state that they may harbor tubercle bacilli when there is

neither macroscopic nor microscopic evidence of their presence. The bacilli may remain for a time in a dormant or so-called "lymphoid state."

The bronchial glands are much more prone to caseous degeneration than the cervical or mesenteric, where the lymphoid state is often of long duration. When the process subsides, the glands frequently become calcareous.

Symptoms.—The onset is usually insidious, Schossman [3] stating that "the lack of cause for the change in the general condition of the child is truly characteristic of tuberculosis of the bronchial lymph-nodes."

The symptoms are in part due to the absorption of the toxins of the tubercle bacilli, and also to the pressure of the glands upon vascular, bronchial, and nervous tissues. The toxic symptoms are familiar to you all. They are: Poor or capricious appetite, fatigue, especially in the morning, languor, irritability of temper, and irregular pyrexia. Dautwiz,[4] in his exhaustive monograph on bronchial gland tuberculosis, mentions as an early symptom a pain of indefinite origin, felt within the chest, which is brought on by deep breathing or vigorous physical exercise. Sometimes there is a substernal pain. Krämer [5] speaks of a constant pain in the mammary region, associated with interscapular dulness, both of which disappear under tuberculin treatment. Huskiness of the voice may be present. Schick [6] has called attention to the expiratory stridor of infants with enlarged bronchial glands. This resembles somewhat the expiration of asthma, but differs in that it is constant, rather than paroxysmal. He attributes it to the pressure of the glands upon the bronchus, and most of the infants whom he observed with this type of respiration died eventually of tuberculosis. An interscapular backache is frequently complained of by adults.

Eventually, a cough begins, and it is because of this symptom that medical advice is usually sought. The typical cough is paroxysmal, "brassy," and quite characteristic. While it often suggests the cough of pertussis, it is not always so severe. I have heard it when it suggested a cavity in the lung. It is of reflex origin, depending upon the pressure of the swollen glands on the vagus nerve. As there appears to be no explanation made as to how this reflex takes place, the following hypothesis is suggested:

Cough, as you know, is usually incited by the stimulation of the terminal filaments of the superior laryngeal nerve, a branch of the vagus, which ramify in the mucous membrane of the larynx.

The vagus is not a sensory nerve below its superior laryngeal branch. MacKenzie [7] has shown that a long-continued stimulation may set up a condition of irritability or hypersensitiveness in nerve-centers. It is possible that such a condition of irritability is brought about in the ganglion of the vagus

trunk by the pressure of the glands, and that, as a result, the superior laryngeal nerve, which arises from the inferior ganglion of the vagus, is stimulated, and a cough results.

This hypothesis would explain the cough of pleurisy, and the tickling in the throat complained of by nearly all incipient cases of tuberculosis. It is possible that the cough of pertussis is occasioned in like manner.

Long-continued pressure may cause erosion of the trachea or bronchi, and the aspiration of the ruptured gland may be followed by a pulmonary lesion.

The esophagus may in like manner be invaded, and fatal hemorrhages have resulted from the erosion of blood-vessels when the lungs have been free from disease.

Fisher [8] reports the case of a boy, aged five, who died from this cause, and Barry [9] tells of the death of a woman of seventy-one whose caseous bronchial gland had caused a rupture of the vena cava. At the autopsy of a man aged twenty-eight who died with symptoms of hemorrhage, Griffin [10] found, in addition to a pleurisy with effusion, intense congestion of the trachea at its bifurcation, and an enlarged and caseous bronchial gland, surrounded by a coagulum the size of an English walnut. The pretracheal glands were moderately enlarged, necrotic, and the seat of numerous hemorrhages.

Another patient of Fisher's [11] a girl of seven, who was in good health, and in whom there was nothing to suggest pulmonary tuberculosis, spat up blood from time to time for over three years.

It seemed desirable to ascertain the reliability of a number of signs said to be indicative of tuberculosis of the endothoracic glands. To this end 175 children have been studied, the results in each instance being compared with the skin tuberculin test—the undiluted "old" tuberculin being used. Some of the children had entered the Hartford Hospital for operation for adenoids and hypertrophied tonsils, and through the courtesy of Dr. Frederick R. Crossfield, I was permitted to examine them. I am indebted to Dr. Albert R. Keith for the opportunity of studying a number of the children at the Hartford Orphan Asylum. The remaining cases were scholars at our Preventorium, or outdoor school.

Inspection.—We observe, in the first place, that the child with tuberculosis of the bronchial glands is usually frail, but this is not always the case, and Dautwiz [12] very truly says that the condition "may hide back of the rosy cheeks of a happy, contented child who is kept in good physical condition."

Seventy-seven out of 146 of our children in whom the appearance was recorded were noted as being frail, and of these, 57 per cent. reacted to tubercu-

lin. Sixty-nine children who were not so classified, but included the robust and "indifferent," were tested, and 32 per cent. reacted.

Fifty-nine children positive to tuberculin who were weighed were, on the average, twelve pounds under weight for their ages.

One should next look for the presence of dilated veins over the anterior aspect of the thorax. These veins were present in 92 out of 173 cases, in this series, 50 per cent. of whom reacted to tuberculin. The presence of dilated capillaries in the region of the seventh cervical vertebra seems to be a sign of less value. Slight puffiness of the face and eyelids from venus obstruction may be present.

One sometimes observes slight inequality in the expansion at the apices. This is best detected by looking down over the anterior aspect of the chest while standing behind the patient. There may even be slight retraction, without disease of the apex. This I have proved by radiographs.

The movements of the Adam's apple should be noted, as de la Camp [13] has observed that in some cases with enlarged thoracic glands it is stationary, instead of descending with inspiration.

PALPATION.—It would seem that palpation affords us the most reliable means of differentiating between active and inactive gland disease. Tenderness over the manubrium sterni and at the sternocostal junction is suggestive of bronchial adenopathy, but these tender areas occur less frequently than tenderness over the spines of the upper thoracic vertebræ. This was first described by Petruschky [14] some years ago, and other clinicians have since attested its value. It is best elicited as follows:

The examiner is seated, and the child, with arms crossed, stands sideways between his knees, in order that the expression of the face may be noted. Then, without explaining what is to be done, firm pressure is made over the vertebral spines. The change of facial expression is the best indication of spinalgia, though in some instances sudden approximation of the scapulæ takes place when the tender spines are palpated. No tenderness being elicited by this means, it is then permissible to ask if all the spines feel just alike, and a repetition of the test may reveal a less marked tenderness. One should make firm pressure of the vertebral spines, going from above downward, and marking any tender spots, then beginning in the lumbar region and going upward. The tenderness at times is extremely acute. It seems to be most often present over the fifth thoracic vertebra, though it is not uncommon to find spinalgia over several of the upper thoracic spines.

Petruschky does not explain what it is due to. He suggests that it may be

caused by a periosteal irritation, the result of disturbances of circulation, or to the presence of minute tuberculous foci in the spinal column.

One should remember that MacKenzie [15] has noted tenderness over the upper four thoracic spines in diseases of the heart, and over the fourth, fifth, sixth, seventh, eighth thoracic vertebræ in stomach lesions. He, too, is unable to explain it. Inasmuch as all these viscera are supplied by the vagus, it would seem as though it were a reflex pain, but just how it takes place is not clear. The spinal tenderness of hysteria and neurasthenia is not limited to the upper thoracic vertebræ.

It is very likely that the backache in the interscapular region, so often complained of by early cases of tuberculosis, is due to tuberculous glands. Petruschky [16] reports 79 cases of spinalgia, 77 of whom reacted to tuberculin. Advanced cases of tuberculosis do not present this phenomenon. The sign was present in 23 out of 58 children of my series, 83 per cent. of whom reacted. Ten adults recently examined in whom there was strong suspicions of an early lesion had spinalgia, 80 per cent. of whom reacted to tuberculin. In both children and adults with toxic symptoms this sign was rarely absent. It has been observed that both rest in bed and the therapeutic use of tuberculin cause a disappearance of the spinal tenderness.

Neiser [17] has developed an ingenious method of palpation, which, however, is not practical in children. He covers the end of a small stomach-tube with a condom, and, after introducing it, 25 to 26 c.c. from the teeth, inflates it through the tube. As the condom becomes distended it presses on the glands, producing the characteristic pain between the shoulder-blades.

A number of observers have found this sign present in a large percentage of cases.

Percussion.—The detection of dulness over the manubrium sternum has little of diagnostic value. Up to about the sixth year the thymus gives a dull note, as a rule. The left lobe, which extends higher than the right, can frequently be detected to the left of the sternum, in the first interspace. According to Tautwiz,[18] the thymus may persist to the thirteenth or fourteenth year. Then, too, so many other structures intervene between the sternum and bronchial glands that manubrial percussion is of little value. Dulness over the sternum, or in the inner third of the first left interspace, was present in forty-one of our cases, forty-nine per cent. of whom reacted to tuberculin.

Parasternal dulness in the second and third interspaces, caused by enlarged hilus glands, was not sought for in this series of cases. It is possible that the dulness occasionally present in the second and third interspaces on the right in the parasternal line with right apical disease is caused by enlarged bronchial

glands, rather than by an increase of cardiac dulness (to which it is commonly attributed) from the retraction of the anterior border of the right lung, caused by cicatrization at the apex. Though, as a rule, little is gained by percussion anteriorly, information of real value may be obtained by posterior percussion. Notwithstanding that spinal percussion was mentioned by Auenbrugger,[19] it has never been extensively practised. Advocated by Ewart[20] and von Korányi,[21] and recently by De Costa,[22] it was de la Camp[23] who made an extensive investigation of its value in the diagnosis of enlarged bronchial glands.

Without going into the elaborate studies of Korányi and Ewart, it is sufficient to state that a dull note is obtained normally over the upper four thoracic vertebræ, and that over the remaining dorsal spines the note is a combination of osteal and pulmonary resonance. Dulness over the fifth or sixth is pathological, and is indicative of mediastinal tumor.

De la Camp attaches great importance to this dulness, and though he found it in only one-third of his cases of enlarged glands, it was in some instances the only sign of their presence. He suggests that percussion at the end of expiration may elicit slight dulness otherwise not demonstrable. Nagel[24] ascertained, by experiments on cadavers, that 10 c.c. of wax injected anterior to the fifth dorsal vertebræ would not produce dulness, but that 15 c.c. so injected would. He believes that the dulness is not so much due to the gland per se as to the lessening of pulmonary resonance, from the pushing aside of the lung by the glands. Percussion of the vertebral spines was performed in only a small number of our cases. It was found at or below the fifth dorsal in 9 out of 40 children who were positive to tuberculin. Seven adults, all of whom had other signs of bronchial gland enlargement, had either vertebral or paravertebral dulness.

Krämer[25] considers spinal percussion greatly inferior to paravertebral percussion. He is convinced, by his investigations, that if one have a true ear and percuss with sufficient delicacy, slight degrees of dulness can be detected whenever there is glandular enlargement. The dulness may or may not merge into apical dulness when the apex is involved. The dulness may be bilateral or unilateral; and when the former, the area of impaired resonance is usually unequal. Krämer attributes the dulness largely to the engorgement of the blood- and lymph-vessels, due to the glandular pressure. He believes that the initial dose of tuberculin should be governed by the size of the area of dulness—the more extensive the dulness, the smaller should be the dose. As in all cases where delicate percussion is employed, more trustworthy results are obtained if the eyes are closed and a dermographic pencil used. The sense of resistance

is perhaps as significant as the impaired resonance. Paravertebral percussion was carried out in too few cases in this series to draw deductions, but in the cases where it was detected, other signs of bronchial glandular enlargement were present. The dulness at the right apex which is sometimes present without disease of the lung, and attributed by Krönig to nasal obstruction from adenoids, is believed by Bing [26] to be due to enlarged bronchial glands, which tend to be arranged more in groups on the right than on the left side.

Auscultation.—Like vertebral percussion, auscultation over the vertebral column has never been widely employed. A few years ago D'Espine [27] called attention to the fact that enlargement of the endothoracic glands gave auscultatory signs that were quite distinctive. In the normal individual the tracheal quality of the respiratory murmur ceases at the seventh cervical vertebra. When the bronchial glands are enlarged, however, the tracheal quality, somewhat diminished in intensity, is continued downward over the thoracic spines for a variable distance. In some instances the bronchial character is absent over the upper thoracic vertebræ, but present at the fifth, and possibly below. Except in the extremely emaciated, one can place the bell of the stethoscope directly over the vertebræ. The character of the voice, especially the whispered voice, affords the most reliable evidence upon which to base a diagnosis of enlarged tracheobronchial glands. The sentence *three thirty-three* is repeated slowly, and when glandular enlargement is present, bronchophony is quite distinct. If one listens with care, it will be observed, in most cases, that the final "e" of the last word "three" is heard for an appreciable time after the voice stops. Gray [28] refers to it as the "post-phonal quality." This is normally present over the trachea. It may be heard over the upper thoracic vertebræ, or only at the level of the fifth dorsal. I have heard it as low as the eighth dorsal. The split syllable, referred to by Gray, was not observed.

As a rule, the bronchial quality is lost when the stethoscope is moved to either side of the vertebral column, but in some cases it is heard as distinctly at one side—rarely at both—as over the spines. In one instance the whispered voice was so marked as to suggest a cavity at the apex of the left lower lobe.

No infants are included in the cases here reported, but the sign is of equal, perhaps of greater, value than in older children, as the signs of pulmonary involvement in infants are notoriously indefinite.

Vertebral bronchophony was present in 80 out of 168 children, and 66 per cent. of those in whom it was detected reacted to tuberculin. Those not giving the sign gave 28 per cent. of positive reactions. Forty-four out of 80 frail children had vertebral bronchophony, and 70 per cent. of these were positive to tuberculin. Thirty-nine of the 80 in whom the sign was negative reacted

to tuberculin. Twenty-four adults who had spinal bronchophony gave 80 per cent. positive reactions.

It is of interest to note that Laennec [20] detected this interscapular bronchophony. He says: "In persons, however, of delicate and feeble frame, particularly in *lean children* [italics supplied], there frequently exists in this (interscapular) situation a bronchophony very similar to the laryngophony already noted." I was not able to detect the weakened inspiration at the apex, which Grancher [30] states is due to bronchial gland disease, and antedates the bronchophony, though faint breathing is commonly present in very early apical lesions. Bronchophony over the sternum was not observed.

Dilated veins over the anterior aspect of the thorax coexisted with vertebral bronchophony in 51 instances, and these cases gave 69 per cent. positive reaction to tuberculin.

Some years ago Eustice Smith [31] called attention to the venous hum heard over the manubrium sterni when the head is hyperextended, which disappears as the head assumes its normal position. He considered it a valuable sign of bronchial gland tuberculosis, and attributed it to the pressure upon the left innominate vein by the glands at the lower end of the trachea. Inasmuch as it is uncommon after the thirteenth year, and as one-half of the 78 of our cases who presented this sign failed to react to tuberculin, its value can be seriously questioned. It seems to be especially common in short-necked children.

Râles.—A little over one year ago Miller and Woodruff [32] drew attention to the presence of crepitant râles in the fourth, fifth, and sixth interspaces, at about the midclavicular line, in many of the children suspected of having tuberculosis. A positive diagnosis of tuberculosis was made in 82 of the cases presenting fine râles near the nipple. Drs. Miller and Woodruff considered the râles very suggestive of a tuberculous lesion at that region.

Râles were present in 46 of 137 of our cases, and except in a very few instances were located in the region of the midclavicular line, in fourth and fifth interspaces. Sixty-five per cent. of children presenting râles reacted to tuberculin, and 38 per cent. of children in whom râles were not detected reacted. Râles were present in 46 per cent. of children reacting to tuberculin and in 22 per cent. of those who did not react.

As only one examination was made in over half of the cases, the observation has less value, as the râles may be heard at one examination and not at another. They seem to be as common in the robust as in the frail child. These râles may indicate a tuberculous focus at that point; but the fact that it does not tend to spread, and later give definite signs of tuberculous infiltration, nor leave

postmortem evidence of a primary disease at that point, is against this supposition.

Radiography.—The *x*-ray is very valuable in the diagnosis of enlarged glands. It requires, however, perfect technic and a large experience in this particular line of work before it is of value; de la Camp [33] considers it the most difficult of *x*-ray work.

Through the courtesy of Dr. Arthur C. Heublein I have been able to compare the physical signs with the *x*-ray plate in 50 cases. Calcified glands are recognized by their sharp, clear-cut shadow. Cheesy glands, according to Nagel [34] give a shadow of less density, and with less clearly marked boundaries. The earliest evidence of tuberculosis of the bronchial glands seems to be a shadow that extends from about the anterior tip of the third rib on the right upward to the first rib. This shadow extends to the right of the vertebræ for a variable distance. It "bulges," as it were, into the region normally occupied by the inner aspect of the right lung. In the figure the extension to the apex is clearly seen. Since making this observation, we find that Sluka [39] has arrived at identically the same conclusion. Krämer [35] attributes this "eaten-out" appearance, sometimes observed at the border of the shadow, to the engorgement of lymph- and blood-vessels. Swollen, but not cheesy, glands, Nagel [36] states, are less clearly or not at all recognizable.

Recently I had an opportunity to apparently confirm this. A patient presenting a large mass of cervical glands entered the Hartford Hospital for operation. A gland fully an inch in diameter, situated nearly behind the left clavicle, failed to cast a shadow, though the bronchial glands could be distinctly seen. At the operation it was found that the gland behind the clavicle was not caseous. It is possible that the dense muscles in which the gland was embedded obscured its shadow. A chain of glands can often be seen along the right border of the heart. The glands about the trachea give a more diffused shadow than the hilus glands.

Dr. Heublein obtained the best results when the anterior aspect of the chest was in contact with the plate. The large infratracheal glands lie posterior to the heart and do not cast a shadow in most cases, though it is not uncommon to see small glands through the heart, near its periphery. The figure, however, shows this infratracheal gland very distinctly opposite the second intercostal space on the right.

Quite commonly one sees an enlarged gland close to a bronchus, which is seen in cross-sections. The figure shows what appears to be the involvement of the lung by contiguity, an infrequent occurrence in adults, though common in infants. The figure seems to show the line of infection along the

lymphatics from a hilus gland to the apex which Sturtz [37] has described. The enlarged glands can be readily seen with the fluoroscope, and their appearance has been described by Dr. Minor.[38] An *x*-ray plate, however, allows some careful study and is a permanent record.

Inasmuch as tuberculosis is not the only disease that causes enlargement of the endothoracic glands it is desirable to substantiate the diagnosis by the use of tuberculin. The skin test of Pirquet is the one of choice in children, bearing in mind, however, that occasionally a reaction will be obtained from the subcutaneous test when the skin test is negative.

The intensification of pressure symptoms following the subcutaneous injection is indicative of a focal reaction in the glands.

In Conclusion.—I. Tuberculosis of the bronchial glands often exists as a distinct clinical entity, capable of diagnosis.

II. While the diagnosis is more readily made in children, it can frequently be made in adults.

III. The presence of dilated veins over the anterior aspect of the chest, spinalgia, interscapular or vertebral dulness, and vertebral bronchophony speak strongly for enlarged bronchial glands, whose tuberculous nature is practically assured when, in addition to the above, the individual is under weight and has a paroxysmal cough and the symptoms of the tuberculous toxemia.

IV. The recognition of the disease, while it is still limited to the bronchial glands, is of the utmost importance, as we know that the most salutary results of tuberculin therapy are obtained in glandular tuberculosis.

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DISCUSSION ON DR. STOLL'S PAPER

Dr. Frederick T. Lord, Boston: When we consider that approximately three-quarters of tuberculous children coming to autopsy have been shown to have tuberculous mediastinal glands, it is evident that we should endeavor to demonstrate them clinically in all children suspected of the disease.

For the purpose of forming a personal opinion of the relative value of the physical signs of tuberculous mediastinal glands I have examined a series of tuberculous children at the Children's Hospital and the Massachusetts Hospital School.* It is needless to refer again to the signs which Dr. Stoll has so fully enumerated, but I should like to comment on certain features.

Two signs have impressed me as of special importance: The presence of an abnormal degree and extent of dulness and resistance in the second interchondral space has seemed of great value. In the interpretation of this finding it must be remembered that there is normally slight dulness extending about one and one-half centimeters to either side of the midsternum in the second space. The demonstration of dulness and resistance over the vertebræ in the normally resonant region between the third and ninth spinous processes has seemed equally significant. General symptoms and the physical signs of mediastinal pressure should of course also be considered.

The venous hum described by Eustice Smith is of considerable interest.

*Through the kindness of Drs. E. H. Bradford and J. E. Fish.

A continuous hum with systolic accentuation may at times be heard in these cases over the upper sternum. It is present in a considerable proportion of cases when the head is slowly extended, and can usually be traced to its point of maximum intensity over the jugular bulb. It was found, however, with equal frequency in a second series of apparently normal children, thus suggesting that it is a normal phenomenon and of no diagnostic importance.

Dr. Charles L. Minor, Asheville: Mr. Chairman, I cannot agree that percussion in the parasternal line is valueless in the investigation of the mediastinal glands. I think it has distinct value if used with care, although I agree with the universal opinion that paravertebral dulness is a sign of greater value. Another distinctly valuable sign is sibilant inspiration transmitted downward toward the lower levels of the trachea. I have found that in diagnosis of tuberculosis of the bronchial glands the *x*-ray examination has gone far ahead of any physical signs, and is the most valuable procedure at our command for the diagnosis of this condition. The use of the *x*-ray also gives us much information as to the progression of the infection from these glands to the apices of the lungs.

Dr. J. H. Lowman, Cleveland: Mr. Chairman, there naturally will always be great variations in the percutory signs in examinations for determining the condition of the mediastinal glands. My observation is that in these cases continued observation is of the utmost importance. There is a collateral inflammation of the bronchi in children with tuberculous bronchial glands, which is apt to be recurrent in the winter, persistent, and gives rise to moist râles, and the whole process on auscultation gives rise to the impression that there has been invasion of the lungs, and one would expect to find bacilli in the sputum. On the contrary, however, residence in the country will cause the whole situation to clear up in a short time. In my opinion this collateral irritation is due to impeded circulation in the blood- and lymph-channels, and to impeded respiration caused by these enlarged mediastinal glands. Now the great difficulty is that such children have usually a bad family ancestry, and presenting this clinical picture are apt to be regarded as actual cases of pulmonary tuberculosis; and, therefore, the continuous observation for which I made an appeal in the beginning of my remarks is more necessary and more important than percussion and auscultation in arriving at correct conclusions.

Dr. H. F. Stoll: In my paper I made the statement that dulness over the manubrium sterni was of no value; not dulness in the parasternal line. I feel indebted to Dr. Lowman for his explanation of the causation of the râles in these cases. I have been confused at times by the presence of râles in certain regions where, for many reasons, the existence of a tuberculous focus was very improbable.

A CONTRIBUTION TO THE STUDY OF PULMONARY TUBERCULOSIS IN ITS RELATION TO ALBUMINURIA

By John Ritter, M.D.
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In the routine examination of the urine, in ordinary urinalysis when testing for albumin, we all know that the presence of a mere trace of albumin, on the one hand, to a more or less massive albuminuria, on the other, is no true guide to determine the degree or severity of the disease. Albumin is quite frequently found in the urine of patients who present no evidence of nephritic disturbance, and who give no symptoms whatsoever of diffuse kidney disorder. Now, if we exclude from the albuminuric findings all those cases which are diagnosed as true Bright's disease, all cases of false or accidental albuminuria, as well as those albuminurias due to renal tuberculosis, febrile albuminuria, and the secondary albuminuria incident to either cardiac or hepatic disease, there remains still a fairly numerous class, and distinct, in the urinary findings of which we as internists should be especially interested and which assuredly deserve our closest consideration. It is to this class particularly that I wish to call your attention. This variety of albuminuria is found chiefly in young and middle-aged individuals who at intervals exhibit a small amount of albumin in the urine without showing any marked systemic disturbances, perhaps possibly a slight feeling of malaise or fatigue on the least exertion.

Professor Joseph Teissier, of France, in a communication to the French Congress for Internal Medicine, has attempted to point out that many of those patients are tuberculous, that the presence of albumin in the urine is only the precursor or forerunner of a positive pulmonary granulation, that this albuminuric syndrome is only a premonitory sign of bacillary infiltration of tuberculous origin, and that the abnormal permeability of the kidney epithelium is induced by the toxic influence of the products of bacteriolysis; in other words, that the preceding albuminuria is usually followed, in shorter or longer time, by a localized tuberculous infiltration generally pulmonary. This assertion is of immense clinical signification, and deserves our most careful study. A very

thorough and exhaustive paper appeared in the last December number of *La Semaine Médicale* by the same author, in which he gives, as additional proof of his observation, the histories of a number of cases to corroborate his former statements. He cites the histories of patients whom he had closely observed for many months, in which the urinary findings showed a distinct albuminuria, and who, although at first presented only a slight indisposition, no other noticeable systemic disturbance, finally developed all the signs of a positive pulmonary involvement. He emphasizes that many of these individuals may have a slight albuminuria lasting for years, but that from the moment when the albumin disappears from the urine, from that moment the pulmonary localization is complete, and that only a short period after the disappearance of the albumin from the urine the tuberculous infiltration of the lungs is demonstrable by the physical signs. He also calls attention to the peculiar character of the albuminuria, being either intermittent, cyclical, or of the orthostatic type. The daily elimination of urine is never very abundant, but rather scanty, pale in the cyclical or intermittent type, while albuminous and darker during the analbuminous period, absence of tube-casts, occasionally a few lymphocytes, excess of phosphates, some mucus, very toxic, no Koch's bacillus, and a high percentage of solid constituents.

This albuminuria is designated by the sufficiently comprehensive name of "pretuberculous albuminuria," and according to his hypothesis this albuminuria and consequent urinary hypertoxicity and increased permeability of the kidney are due to either tuberculins or to some other toxic agent, most probably a derivative of bacillary destruction, by the resisting tissues of the body. The economy-invading bacilli are mostly destroyed in the beginning, and that the product of this disintegration, being eliminated in the usual way through the renal epithelium, produces sufficient toxic action to induce the albuminuria, and that so long as this destruction of the invading bacilli continues, so long will the elimination of albumin continue, but that there finally comes a period in which the antitoxins or the agents of bacteriolysis are no longer able to induce bacillary destruction, then the albuminuria and the hypertoxicity of the urine ceases, and now the bacilli of Koch, being no longer hindered in their growth, an active invasion of the pulmonary tissue, a pulmonary granular proliferation, takes place and progressively all the signs of pulmonary tuberculosis make themselves manifest. This is the theory as it has been advanced by members of the French school, and, if true, this most valuable contribution undoubtedly opens up a new and a most interesting field for the close study and the early recognition of tuberculosis. If it is a fact that in a number of cases an albuminuria precedes a pulmonary infiltration, this fact has not been generally recognized nor known by the profession. When

we reflect that the urinary findings are not constant, that an ordinary examination of a twenty-four-hour specimen of urine does not give us an absolutely true picture, that albumin at times may or may not be present, we must conclude that in any given case an innumerable urinary examination must be made in order to arrive at exact conclusions.

Much evidence still remains to be gathered to either prove or disprove this theory. I had endeavored to add some corroborative evidence to this hypothesis, and with that end in view I began, many months ago, to make the urinary examinations of urine collected at different days and at different hours during the day. The urine was obtained from a large number of patients, chiefly from young individuals and children, and especially that from children who gave a history of parental tuberculosis. I found only a few specimens that gave an albuminous reaction out of many urinary examinations, and as most of these cases are still under observation, it is yet too early to make any positive statements, and their findings must be deferred for future discussion. As the assertion is made that with the advent of the pulmonary infiltration the albuminuria clears up or ceases entirely, one would naturally expect an absence of albumin from the urine in all cases in which the physical findings are conclusive.

At the Edwards Sanatorium at Naperville, Illinois, I examined the records of 100 cases, selected at random, and who, at the time of admission, were diagnosed as moderately advanced, and in all of which at that time a urinary examination was made, and not in a single instance did I find in these records any notation of albumin being found at these examinations. In the records of some 200 cases at the Ottawa Tent Colony at Ottawa, Illinois, the findings are similar, in the moderately advanced cases, to those of the Edwards Sanatorium. In looking over the records of cases at the Ottawa Tent Colony I find several in which the history, the examination, temperature, and pulse left some doubt as to a positive diagnosis being made, being very incipient, but the urinary findings showed a trace of albumin; from this may we not conclude that most probably these are cases just on the border-line, when the albuminuria ceases and pulmonary lesions begin?

When we consider what has been said concerning this albuminuric syndrome, that in a great many cases the presence of albumin in the urine may be the precursor or forerunner of a tuberculous infiltration of the lung, that albumin may be found in the urine for many months and even years before any physical signs are demonstrable, may we not conclude, and most reasonably, that many cases which were formerly classified as cases of physiological albuminuria and all those cases known as intermittent or cyclical albuminuria in children, as well as the albuminuria of adolescence, were all, in most probability, cases of "pretuberculous albuminuria?"

STEREOSCOPIC RADIOGRAPHY AS DIAGNOSTIC AID IN PULMONARY TUBERCULOSIS

By Emil G. Beck, M.D.
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(Read by Title)

For nearly thirteen years radiography of the chest has been employed as a diagnostic aid in pulmonary tuberculosis, and its utility highly recommended by the foremost clinicians in the world, but, strange to say, it has not yet become very popular.

Authorities, such as Rieder,[1] Albers Schoenberg,[2] Kyritz,[3] Krause,[4] Wolff,[5] Pfahler,[6] Levy-Dorn and Cornet,[7] Holland,[8] Wenckebach,[9] Arnsperger,[10] have furnished splendid illustrations of its diagnostic value, so that we wonder why the medical profession is so sluggish in accepting a diagnostic aid recommended by such reliable men.

Two obstacles seem to impede the way to its extensive use: *First, the cost; second, the lack of facilities* for obtaining perfect radiographs by the general practitioner.

Even perfect radiographs are not appreciated by all, because it requires a certain amount of practice to make correct interpretation, and to those who are not familiar with this work the radiographer's interpretation is not always convincing. They suspect that the enthusiastic radiographer is apt to make false deductions, being influenced and misled by what he wishes to find.

To a certain extent the general practitioner is justified in his conservatism. He does not wish to employ a method the advantages of which he himself cannot see. Even experts confess their inability to explain all radiographic shadows, the most perfect plates often displaying mysterious findings.

Therefore, we cannot expect the chest radiograph to become popular as a diagnostic aid in pulmonary tuberculosis until we furnish the practitioner with a photographic plate which he himself can interpret.

Stereoscopic radiography appeals to me as the most promising possibility in attaining this end. I desire to report my experience with this advanced method, and state beforehand that its advantages are so pronounced and so

easily demonstrated that I expect to arouse an interest in those who still regard radiography of the chest of doubtful diagnostic value. One cannot, however, be too emphatic in stating that the radiogram, no matter how perfect it may be, can be regarded *only as a diagnostic aid* to the other methods of examination, and not as their substitute. He who will diagnosticate with the *x*-ray alone will make many blunders, and soon learn that he must employ at the same time the other well-tested methods of examination and then use the radiogram to confirm his diagnosis.

In the fall of 1907 I began to employ stereoscopic radiographs for practical purposes, namely: To trace fistulous tracts and empyema (Beck [11]) by means of the bismuth paste injections (Stereo 1).* While we have also employed it in the diagnosis of other diseases of the chest (Beck [12]), a special study of its value in the diagnosis of pulmonary tuberculosis has been carried on by me for the past two years.

A series of 75 cases, from the practices of my brothers, Drs. Carl and Joseph Beck, as well as my own, including some from the public sanitarium for the tuberculous at Dunning, Illinois (a State institution which takes care of about 450 consumptives in advanced stages), forms the basis of this report.

The method, as we know, consists of the taking of two separate skiagraphs of the same region of the body from different angles, without changing the position of the patient during the two exposures.

After the plates are developed they are placed side by side and viewed by means of a pair of prisms, and thus the stereoscopic view is obtained.

Stereoscopic radiography has been employed in this country (Kassabian [13]) and abroad since the discovery of the *x*-ray, but its practical diagnostic value in pulmonary tuberculosis has not been sufficiently brought to the attention of the medical profession. The work of Professor Wenckebach, at the University of Gröningen, and his excellent illustrations, and that of Alban Koehler, have stimulated me to perfect this method and to further its practical application. After one has employed this stereoscopic method of radiography he will no longer be satisfied with the single plates, and realize under what disadvantages he was working when using non-stereoscopic plates. One obtains an entirely new conception of this science and recalls the numerous errors of the past which resulted from false interpretation of single radiographs.

* Copies of the Stereoscopic cards referred to in this paper may be obtained by application to the author or they may be found in the *Fortschritte auf dem Gebiete der Roentgenstrahlen*, B. xv, 5, p 303. 1910.

NON-STEREOSCOPIC RADIOGRAPHY

The single radiograph is merely a shadow picture of the objects placed between the anode of the *x*-ray tube and the sensitive plate. The shadows thus produced appear in one plane, so that one is unable to judge whether the object producing them is located on the anterior or posterior part of the chest.

Overlapping shadows, produced by two or more objects, which happen to be in line with the source of the rays, will appear as one single, although somewhat intensified, shadow.

Moreover, the size of the object is distorted, depending altogether upon the distance of the same from the sensitive plate. For instance: A lesion the size of a hazel-nut, located on the posterior part of the lung, will give a distinct shadow not much larger than its actual size, while the same lesion, located on the anterior part of the lung, will produce a shadow twice its actual size, but much less distinct in outline.

A convincing illustration of this fact is seen when the stereoscopic card (Stereo 2) is viewed. It represents a radiograph of four coins (American half-dollars, which, of course, are all the same size), placed side by side on a wire screen, each coin, however, being placed at a different level from this screen, supported at the different heights by various thicknesses of cotton. The first coin is directly on the wire screen, the second is one inch higher, the third two inches, and the fourth is three inches above the screen. (The upper set is transposed to show a pseudoscopic view, referred to later.)

In the single plate the difference in the sizes of the coins due to spreading of the shadow is quite apparent, and the difference of shadow-intensity quite perceptible, and all coins appear to lie directly on the screen.

In viewing the lower set of coins by means of the stereoscope all four coins appear of equal size; the difference in the intensity of the shadows is not nearly so marked, and their relative distance from the screen quite distinct. (See lower set of coins, marked "Stereoscopic.")

This holds good only when the plates are viewed in the same way in which they were taken, *i. e.*, the coins to appear between the wire screen and the observer. By transposing the plates, that is, by shifting the right plate to the left and the left plate to the right, without turning them, the difference in the size will appear even more exaggerated. (See upper set of coins, marked "Pseudoscopic," on card 2.)

Another disadvantage of the single *x*-ray plate is the fact that the translucent lung is obscured by the shadow of the heart, the ribs, and the overlapping clavicles. It is unusual to obtain a clear apex, since the forward

curve of the first rib and the overlapping clavicle often obscure the entire space of the apex.

How is one to make correct deductions when such physical obstacles are to be overcome?

STEREOSCOPIC RADIOGRAPH

The stereoradiograph overcomes many of these difficulties. The fusion of the two pictures into one by means of the prism glasses builds up a translucent body resembling a glass model, in which all structures can be plainly distinguished. *The radiograph really ceases to be a shadow.* The plastic effect produces clearer outlines of structures, and all parts stand out distinctly, so that the distance between them can be estimated.

The bones become more translucent, and the convexity or concavity is easily discerned. The overlapping of the clavicle and the first rib is of little consequence since the translucency of the bones permits inspection of the hollow space between them.

Lesions within the chest are thus easily located and their density and contour determined without difficulty. The distortion of size of structures, the fault of single radiographs, is corrected in the stereoradiograph, because it produces a true optical view. Another advantage is the possibility of inspecting the chest anteroposteriorly, as well as posteroanteriorly, by simply transposing the plates.

In the anteroposterior view one can note distinctly that the spinal column and scapulæ are behind the heart, and that the ribs curve forward, while the clavicle appears to stand out about one inch anterior to the chest-wall. By transposing the plates the entire picture is reversed, as though the subject were viewed through the back.

The correct way of inspecting the plates, however, is to view them in the same relation in which they were taken; in other words, if a chest has been taken dorsoventrally, it should be viewed dorsoventrally. The reason for this is explained by the coin experiment.

A practical illustration by means of the stereoradiograph is more convincing than a mere description, or even by the reproduction on small cards, where a great deal of the detail is lost. The interpretation of single plates requires a great deal of experience, but the stereoscopic examination is so convincing that an intelligent layman may understand it.

The following points will be illustrated:

1. That the early signs of infiltration of the lung may be shown, where the diagnosis by other methods is doubtful.

2. That when diagnosis is certain, the extent of the tuberculous disease and formation of cavities may be demonstrated.

3. That an active tuberculous process may be differentiated from a latent one by means of the radiograms.

4. That the bronchial tree produces shadows which must not be mistaken for tuberculous foci or peribronchial glands.

INCIPIENT TUBERCULOSIS

Stereo 3 illustrates an infiltration of both apices in a case of incipient tuberculosis.

A. V., twenty-six years old, had never suffered with any affection of the lung until May, 1909, when he noticed a daily rise of his temperature and loss of weight. In July, 1909, he requested an examination because of loss of strength and fifteen pounds in weight. Aside from the positive Pirquet test and loss of weight, with daily elevation of temperature to 99.6°, we could find no symptoms indicating tuberculosis. The stereoradiograph, however, clearly showed an infiltration in both apices (Stereo 3). The patient was kept in Chicago for two weeks for observation, during which time he developed a slight cough and further loss in weight, his temperature rising to 100° every evening. He was advised to go to Colorado, where our diagnosis was confirmed and proper treatment instituted.

In this case the radiograph was the deciding factor in the early recognition of the pulmonary disease. The cloudiness in the apex indicated that the disease was not sufficiently advanced to produce any signs which could have been discovered by auscultation or percussion, but in connection with a positive "von Pirquet" test, fever, and loss of weight, one could hardly hesitate to pronounce it a case of incipient tuberculosis.

In our series we have met with a number of cases of this type, and, as a rule, the subsequent history proved our diagnosis to be correct. Again, in a number of cases where the disease was suspected the radiographs proved the suspicion unfounded.

Before illustrating the difference between the active and latent tuberculosis I will try to account for the frequency of the shadows in all chest radiographs.

It is known that mottled shadows and strands near the root are found in radiographs taken of perfectly healthy persons, when tuberculosis is not even suspected. In fact, perfectly clear chests are exceptional. At the root there are nearly always a number of spots, three or four on each side, which are usually supposed to be cicatrices or calcified peribronchial glands. From the

root we often find a number of strands running upward toward the apex, and some downward, especially on the right side. The latter have been called "Lymphstränge" by Germans, and are sometimes taken to be cicatrices from healed-out tuberculous processes. In taking radiographs we not infrequently find large areas of the lung studded with small, star-like spots, in perfectly healthy persons, with no symptoms to account for the same.

To illustrate this we have taken chest stereoradiographs of ten perfectly healthy nurses, ranging from twenty to forty years of age, and have found in only one what we could pronounce a clear lung. The other nine showed the signs referred to.

To a novice these findings must prove very confusing. How is he to judge whether a patient has tuberculosis, when nearly all chest pictures show similar spots and streaks?

The shadows and strands usually running from the root of the lung were always a puzzle to me until their real significance was revealed by the following study. Their origin has been a disputed subject by many observers, the opinions varying so much that it was difficult to know to which theory to lean. Some claim that these root shadows are due to the folds of the pleura (Halls Dally); other authors claim that they are the shadows of blood-vessels or lymph-channels. An interesting and most reliable study was published by de la Camp[14] in 1904, and his conclusions that the root shadow ("Heiluszeichnung") is produced by the bronchial system still holds its place among most of the radiologists.

The similarity in the topography of these streaks to the branches of the bronchial tree was so suggestive that I decided to study the anatomical distribution of the bronchi in order to ascertain if these streaks were really the shadows of the bronchi. For this purpose I injected the bronchial tract of a fresh cadaver with 200 grams of liquefied bismuth-vaselin paste, and took a stereoscopic radiograph of this chest (Stereo 4). The picture thus obtained furnished a true reproduction of the bronchial tree *in situ*, with plastic effect, clearly showing the relations of all the structures within the chest.

The division of the trachea in this case took place opposite the sixth dorsal vertebra. It is generally assumed that the right bronchus is a continuation of the trachea. Practically, this is the case, but if one wishes to be exact, our radiographs shows that this statement must be modified. Exact measurements in this case show that the right bronchus deviates seventeen degrees and the left forty degrees from the line of the trachea. These angles may vary in different subjects. A repetition of this means of measurement in a large series of cases would be a reliable method of determining the question.

The number of subdivisions in the bronchi are not uniform in all parts (varying from six to ten), the bronchi running toward the lower lobes having more subdivisions. The bronchioles appear somewhat beaded, due, probably, to overdistention by the paste. Even the smallest bronchioles, and in a few places the air-vesicles, have been injected. The latter resemble small bunches of cauliflower, placed at the ends of the bronchioles.

To explain the displacement of the air within the bronchi we can only assume that it has been forced into the partially collapsed air-vesicles.

Comparing the distribution of branches of this bronchial tree with the perplexing streak shadows of our chest radiographs, one is struck by the resemblance of their course, and, in fact, accurate measurements demonstrate that these streaks are undoubtedly the shadows of our bronchial tree. We find, for instance, in practically all cases where this bronchial shadow is present, a triangle, the base of which is formed by the lower border of the fourth rib, the apex pointing to the fifth rib, just about two inches from the border of the spinal column. Any one may convince himself of this fact by looking over the chest plates taken in the past, or by looking through the atlas, or past numbers of journals which contain hundreds of such chest radiographs. There are other landmarks which correspond to the branches of the bronchi, so that the correctness of the origin of these shadows cannot be doubted; for instance:

Close examination of this radiograph of the bronchial tree reveals that there is not a trace of the spots and strands usually present in other chest pictures taken of the living. The explanation is very simple when one reflects that the opacity of the material injected into the bronchi covers up all traces of these strands. This further corroborates my assertion that these strands represent the heavy branches of the bronchial tree.

Experiments, in 1905, by Dr. Hickey,[15] of Detroit, indicate that these shadows are due to pulmonary vessels, but the fact that these shadows are obliterated when the bronchi are injected, and, furthermore, that the parallel lines of the bronchial tubes are distinct, favor the de la Camp theory, namely, that the bronchi are the factors causing these hilus streaks.

The question now arises: Which constituent of the bronchi produces the shadow? Is it the cartilage, an inflammatory process, or peribronchial glands? No doubt all these factors may contribute to the density of the bronchial wall, but I am convinced that the sclerotic change in the tissue is the chief factor, because I find these bronchial shadows very much marked in old people, and almost absent in children. I have excluded the possibility that the duct in the bronchial tubes could be the important factor by taking radiographs of coal-shovelers just as they had finished a day's work. Their lungs did not show

these bronchial shadows very clearly, probably because they were young individuals. This question is, however, not definitely settled. It will require an extensive study of a series of postmortem cases, with microscopic examination of the bronchial walls, in order to determine which of these factors are most prominent in producing these bronchial streaks.

We believe thus to have helped in clearing the perplexity of interpreting the various chest shadows in the radiograph, and thus the most confusing obstacle is removed and we can proceed to illustrate the diagnostic possibility of the stereoradiograph in differentiating an active tuberculosis from a post-tuberculous lung.

The distinguishing feature between the active and latent tuberculous process is this: In the active state the foci of infection are shown by shadow spots, each surrounded by a halo, which merge into other similar foci, so that frequently a large portion of the lung appears solidified. This halo, no doubt, represents an area of infiltration about a tuberculous focus.

Quite different are the findings in the latent or post-tubercular state, where, by physical examination, the resonance of the lung is perfect, and no other symptoms of tuberculosis are demonstrated. Here we discern the cicatrices remaining after the disease has healed, standing out clearly, resembling spider-like figures embedded in entirely clear lung tissue.

The distinction between these two conditions is illustrated by stereoradiographs Nos. 5 and 6.

ACTIVE TUBERCULOSIS

Stereo 5 represents the active disease. The patient, a young man of twenty-six, an inmate of the Tuberculosis Institute at Dunning, Illinois, is in the advanced stages of tuberculosis, as may be judged from the radiograph alone. Viewing the single plate, it appears that nearly the entire lung is solidified, the shadows covering nearly the entire area of the lungs. Viewing, however, the stereoscopic pair by means of the prisms, this illusion is dispelled. We obtain a correct optical view. The shadows which, in the single plate, were spread in one plane, on the plate are now shifted in the various depths of the chest, so that they appear like solid bodies embedded in clear lung tissue, and the consolidation does not appear nearly so extensive.

POST-TUBERCULOUS LUNG

Stereo 6 illustrates the post-tubercular state. A young man of twenty-four years, who for sixteen years had tuberculous sinuses of his right knee, applied

to me for treatment. The affected limb was six inches shorter than the other, due to atrophy. Regarding the limb as useless, I advised amputation above the knee, which I performed, and an artificial limb was substituted. This patient gave a history of a prolonged sickness in his childhood, which suggested to me that he might at one time have been also afflicted with pulmonary tuberculosis. At present there are absolutely no symptoms suggesting this disease. His lung is perfectly resonant; he has not coughed for years, nor has he been subject to "colds."

To satisfy my curiosity, we took a set of stereoscopic chest radiographs, which proved quite clearly the healed-out tuberculous process, Stereo 6 showing the upper part of the right lung, studded with well-defined fibrous scars, surrounded by translucent lung.

In *advanced cases* the stereoradiograph furnishes great assistance in the prognosis. It enables us to recognize cavities in the lung, and plainly shows the extent of the disease.

TUBERCULOUS CAVITY

That tuberculous cavities may be better distinguished by stereoscopic radiographs is shown in Stereo 7. Here we find a cavity in the right lung with well-defined walls. The cavity was diagnosed during life-time, and also found at the postmortem. One is not apt to mistake a pneumothorax for a tuberculous cavity. The characteristic infiltrated wall so plainly shown in the tuberculous cavity is absent in pneumothorax (Fig. 2). Moreover, we usually find the pneumothorax adjacent to the chest-wall, while the cavities are found mostly in the center of the lung or near the apex.

With these illustrations I trust to have helped in establishing the use of the stereoradiograph as a diagnostic aid in pulmonary tuberculosis, and hope that the students of tuberculosis will interest themselves in this most valuable aid and put it into practice.

What are the objections to the stereoradiograph? The principal one is the additional cost. We realize that in order to make a method popular it must be simple and not too expensive. I regret that this method does not fill entirely these two requirements, but it has offered us such advantages that we have entirely lost sight of its cost, and now employ it almost exclusively, not only in the chest, but in radiography of all parts of the body, including the head.

In institutions in which a radiographer is employed the expenditure is reduced to a minimum, and in private practice the expense of a radiograph should not stand in the way of assisting the physician to make or to verify a diagnosis of such vast importance.

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ARTIFICIAL LYMPHOCYTOSIS IN TUBERCULOSIS

By Gerald Bertram Webb, M.D., Wm. Whitridge Williams, M.D., and A. F. Basinger, M.D.

Colorado Springs, Colo.

At the 1909 meeting of this Association a paper[1] was read, entitled "Some Hematological Studies in Tuberculosis," which contained details of a change in the differential blood-picture brought about by altitude, which had not before been noted.

This change consisted in an increase of lymphocytes, and is well seen in the following chart.

Dr. Basinger, who joined us in the present work, arrived in Colorado Springs (6000 feet) in August, 1909, and at once essayed to show, by his own blood examinations, that our observations might be wrong.

It is especially to be noted in this chart that the large lymphocytes increased from 170 per c.mm. on arrival to a permanent height of 2000 per c.mm., as it is this cell which would appear to have the power of destroying the tubercle bacillus.

The chart also illustrates well the biologic phenomenon of overproduction, which we find to be constant in our blood counts during the first two weeks of residence here of a healthy adult from sea-level.*

The total lymphocytes increased from 2400 on arrival to 4200 at the end of two weeks, and then dropped to 3800, where they have since remained.

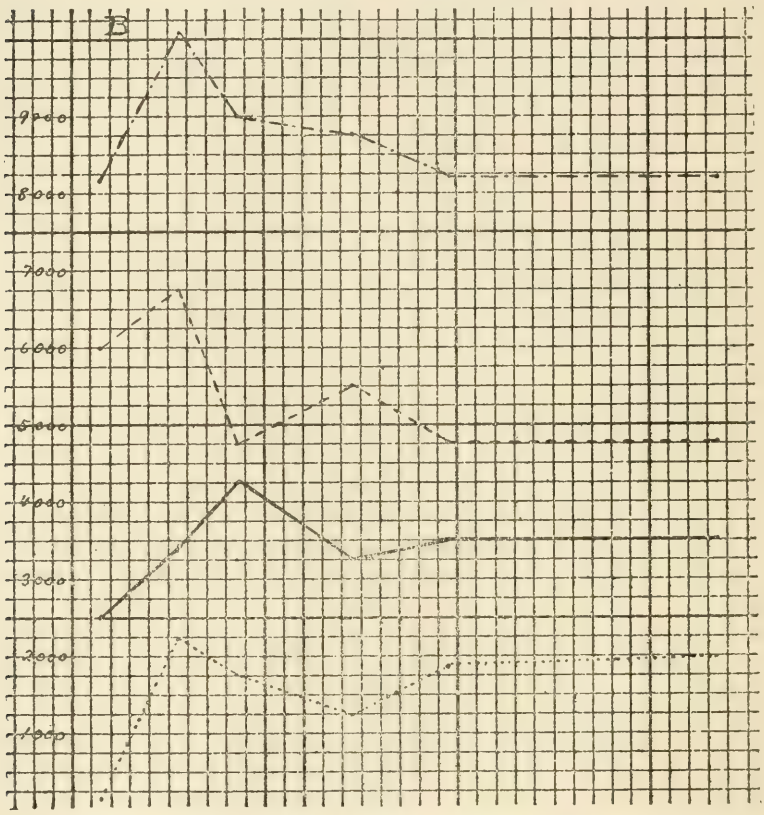
Reference to our former paper[1] will show why the lymphocyte is considered of such importance in the defense against tuberculosis, and consequently why we consider the increase in these cells brought about by altitude as being of such importance in the cure of tuberculous invalids and in the high degree of immunity our residents possess to this disease. We reason that the same factor which causes the increase of the red corpuscles in altitude must also

* Dr. Henry Sewall,[2] of Denver, some years ago pointed out that a characteristic effect of high altitude upon the circulation is an overloading pressure of the right side of the heart. This may have a bearing on the marrow hyperplasia of altitude.

originate the increase of the lymphocytes, namely, marrow hyperplasia, as shown by Züntz.[3]

Josué[4] shows that in localized experimental tuberculosis in rabbits the bone-marrow responds to infection by a very intense proliferation of the

The accompanying chart records his observations



Explanation of Chart I. –.–.–.–.–. Total leukocytes per c.mm. – – – – – – Total polymorphonuclears per c.mm. ———— Total mononuclears per c.mm. . . . . Large lymphocytes per c.mm.

mononuclear leukocytes, and also that the subcutaneous injection of tuberculin will bring about similar marrow activity.

He states that a comparable phenomenon occurs in man. It can, therefore, be considered that by removing a suitable tuberculous invalid to an

altitude, nature is being aided by the stimulation given to the lymphoid marrow tissue.

In addition to evidence referred to[1] as to the defensive behavior of lymphocytes, Daels[5] has shown that the von Pirquet skin reaction to tuberculin is characterized by the collection of lymphoid cells at the irritated area.

Cadbury[6] found in patients dying of pulmonary tuberculosis that if the bone-marrow was found proliferated, it was practically the rule to find a considerable number of lymphocytes.

It is especially noteworthy that during the past year Bergel,[7] in Germany, and Marie and Fiessinger,[8] in France, have made the important discovery that the lymphocytes contain a ferment of lipolytic power capable of splitting wax and fat into glycerin and fatty acids. Following Opie's method of nomenclature, we would suggest for this ferment the name of lympholipase. It has long been known that at least 30 per cent. by weight of the body of the tubercle bacillus is composed of waxy substances, and the chronicity of tuberculosis has been thought to be due to the difficulty the defensive mechanism of the host must have to destroy this waxy substance. The importance, therefore, of the discovery of the increase in lymphocytes due to altitude is enhanced by the discovery of lympholipase.

Pribram[9] believes in a lipolytic ferment being present in the blood, but does not feel sure, on account of his failure in a small number of experiments, that it is yet completely proved that lipase originates in the lymphocytes.*

We have ourselves studied the lysis of tubercle bacilli by the lymphocytes of cockroaches and grasshoppers. These insects would seem to have entirely this type of cell, corresponding to our large lymphocytes.

Injections of tubercle bacilli can readily be made into one hind leg, and at various intervals lymphocytes containing tubercle bacilli in all stages of digestion can be found by withdrawing some circulating fluid from the other hind leg.

We have been struck by the length of time necessary for this digestion—often several days and not several hours only, as might be thought.

* As this paper goes to press an excellent article appears by Fiessinger,[15] on the part played by lipase in the defense against tuberculosis. Plates are also given which illustrate the lysis of tubercle bacilli by the lymphocytes of the bee moth larva.

Fiessinger concludes that the lymphocytes furnish lipase, which destroys the waxy parts of the tubercle bacillus, and that it is then necessary for the polymorphonuclear leukocytes to appear with their leukoprotease, which only works in an alkaline medium, to complete the digestion.

He would seem to overlook the fact that the lympholipase, by splitting wax into fatty acid and glycerin, might supply the acid medium in which the lymphoprotease could act.

Then, too, we know that complete lysis can proceed in insects which have no polymorphonuclear leukocytes, but only lymphocytes.

It has been shown by Opie[10] that the injection of living leukocytes, consisting of an approximately equal suspension of polymorphonuclear and of mononuclear cells, obtained from normal dogs and injected into dogs which have been artificially infected with the tubercle bacillus, can inhibit the development of tuberculous lesions. This would seem to show the value of increasing the numbers of leukocytes.

Following our observations on the effect of altitude in increasing the lymphocytes it was now argued that if bone-marrow hyperplasia provoked the increase of mononuclears reported, then artificial hyperemia of accessible bones might yield the same result. To this end a rubber bandage was applied as a tourniquet to the legs, as high up the thighs as possible, with sufficient pressure to interfere with the return venous flow, but not enough to obstruct the arterial.

The following chart represents the results of the first application of this method to man:

NORMALS. ONE HOUR

	Total Leukocytes			Percentage Mononuclears			Total Mononuclears			Total Polymorphonuclears			Percentage of Change			
													Mononuclears		Polymorphonuclears	
	Before.	During.	After.	B	D	A	B	D	A	B	D	A	D	A	D	A
I.	6684	7372	14784	39.0	46.5	55.0	2607	3428	8131	4010	3907	6579	+30	+211	—2.5	+115
II.	9000	11280	14556	39.5	43.5	41.0	3911	4907	5968	5940	6317	8588	+25	+ 52	+ 6	+ 45
III.	5460	..	8280	51.5	..	61.0	2811	..	5050	2457	..	3229	..	+ 79	..	+ 31
IV.	11076	11208	15504	42.0	44.0	50.0	4652	4932	7752	6092	5884	6977	+ 6	+ 69	— 3	+ 14
V.	7620	8496	11844	50.5	41.0	49.0	3848	3483	5804	3620	4758	5567	— 9	+ 50	+ 31	+ 53
VI.	5976	..	5526	53.0	..	52.0	3167	..	2874	2809	..	2652	..	— 9	..	— 5.5

NORMALS. ONE-HALF HOUR

VII.	9816	..	12168	37.5	..	39.5	3681	..	4806	5939	..	7118	..	+ 30	..	+ 20
VIII.	11472	..	16416	38.5	..	33.0	4407	..	5417	6482	..	10588	..	+ 23	..	+ 63
IX.	5040	..	5676	61.5	..	51.0	3100	..	2895	1940	..	2753	..	— 7	..	— 42

TUBERCULOUS

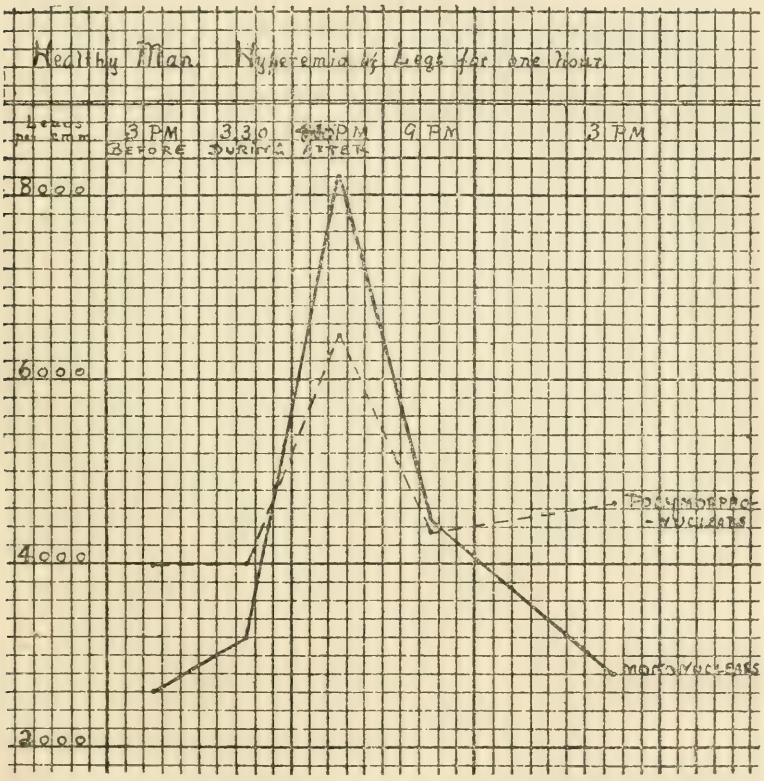
X.	7692	7560	10560	40.0	41.5	41.5	3077	3137	4382	4061	4082	5649	+ 2	+ 42	— 18	+ 14
XI.	15372	..	15768	23.0	..	27.5	3536	..	4336	11836	..	11432	..	+ 23	..	— 3
XII.	10176	..	10936	36.0	..	37.0	3653	..	4046	6258	..	6835	..	+ 10	..	+ 9
XIII.	7440	..	9600	36.0	..	34.0	2678	..	3264	4724	..	6240	..	+ 22	..	+ 32
XIV.	14136	..	18204	21.5	..	37.5	3039	..	6826	10743	..	11286	..	+125	..	+ 5

I and IV, bandage removed at end of fifty minutes, due to patient complaining of faintness, nausea, and failing vision. V, forty minutes, nausea and faintness; VI, fifty minutes; IX, twenty-five minutes, throbbing in legs; X, fifty-three minutes, nausea; XI, forty-five minutes; XII, forty minutes; XIII, thirty minutes; XIV, twenty-three minutes, nausea and vomiting.

The results so obtained are an average total of mononuclear increase of 75 per cent. in normal individuals after one hour's application, and 18 per cent. increase of mononuclears after one-half hour treatment. The mononuclear increase is much more marked than the polymorphonuclear. Two nucleated red corpuscles (normoblasts) were observed in the blood slide from case 1.

The subjective symptoms are: A swelling of the legs, the skin becoming reddened or even bluish, and a feeling of drowsiness in most cases; local discomfort is not marked, but some numbness and tingling occur.

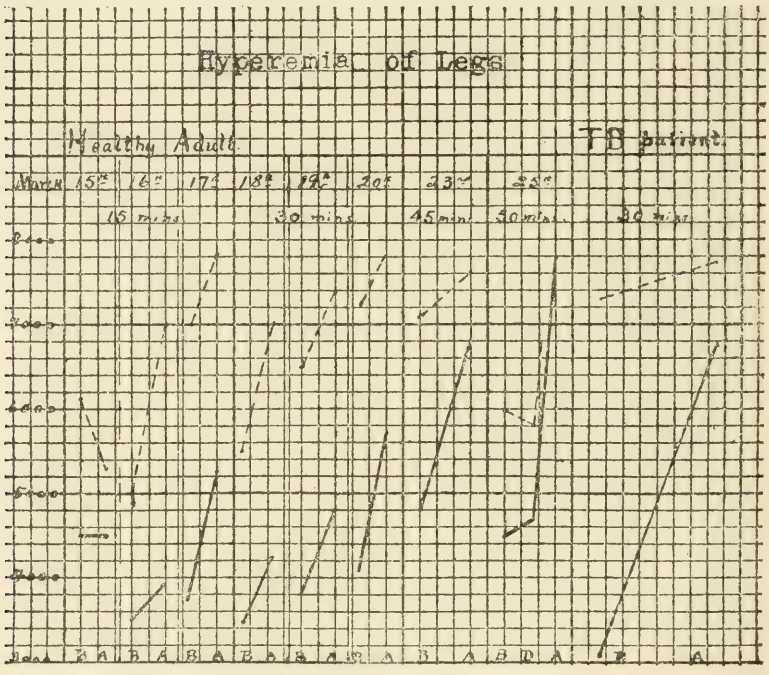
The following charts illustrate graphically such experiments:



The question naturally arises, can the marrow-cells so supplied with excess of blood actually multiply in this length of time?

Carnegie Dickson[11] states that mitosis is a comparatively rapid process in the marrow, and it is for this reason that even in proliferating marrow karyokinetic figures are rare.

Dickson, in replying to a letter asking how long a time would be necessary for marrow-cells to divide, writes: "With regard to your query *re* cell division,



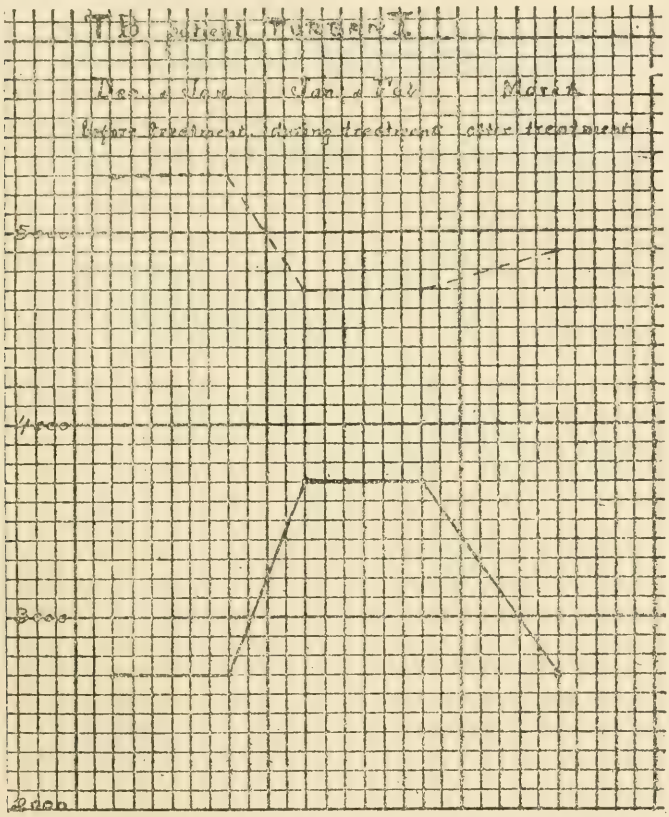
B = before hyperemia of legs.
A = after hyperemia of legs.

I should think that cell division can certainly occur within the limits of time you mention (fifteen minutes to an hour), although I have no direct evidence to prove it, yet I think that the indirect evidence on the subject renders the statement a fairly safe one.

Ross and Macalister,[12] in an article "On Cancer Research," have made interesting observations on lymphocytes. They state that these cells contain no Altmann granules in their cytoplasm, as do the polymorphonuclear leuko-

cytes. The lymphocytes contain, however, granules arranged on the walls of their nuclei, which give the chromatin reaction with certain stains.

By using a jelly considered to possess a reproductive excitant, mitosis of lymphocytes was discovered, and the granules mentioned collected around the equator of the now spindled-shaped nucleus and divided into sixteen portions, which appeared as chromosomes.



During January and February the cough and expectoration ceased, and six pounds in weight were gained.

Mitosis of a lymphocyte would appear, from the experiments described, to take place in a few minutes.

The authors are inclined to believe that lymphocytes are reproductive, and, therefore, remarkably different from the polymorphonuclear leukocytes.

We have frequently seen in blood-smears following the artificial marrow hyperemia large lymphocytes with two or three segments in the nuclei and others cell distinctly multinucleated.

The changes in the blood-picture do not take place in a few minutes, as would be expected by a mere flushing out, and the greatest results obtained have been after from one-half hour to an hour.

In an address on artificial lymphocytosis before the Denver County Medical Society in April, 1910, it was stated that lymphocytosis could also be produced by constant hyperemia of accessible long bones, as the following observations attest.

These patients applied to the upper arms, day and night, garter elastic, one inch wide, which was just tight enough to leave an indentation in the skin after removal. They suffered no discomfort, neither did the arms visibly swell.

Mr. M.—Cured pulmonary tuberculosis.

	Polymorphonuclears	Small Lymphocytes	Large Lymphocytes	Large Mononuclears	Transitionals	Total Per Cent. Lymphocytes	Eosinophiles	Mast Cells	Total Leukocytes
At start	61.0	8.0	29.0	2.0	..	(39)	..	..	
After one week	51.0	6.5	38.5	2.5	1.0	(47.5)	1.0	0.5	
After two weeks	32.0	18.5	48.0	1.0	..	(67.5)	..	0.5	
Hyperemia omitted one week	57.5	16.5	16.5	6.5	2.5	(42)	..	0.5	
Mrs. R.—Pulmonary tuberculosis. Turban III.									
At start	69.5	1.0	28.0	1.0	..	(30.0)	0.5	..	
After five days	52.5	7.5	38.0	1.0	..	(46.5)	..	1.0	
After ten days	49.5	9.5	38.5	2.0	..	(50.0)	0.5	..	
Hyperemia omitted for one week	62.5	12.0	21.5	2.5	1.5	(37.5)	..	..	
Mr. S.—Pulmonary tuberculosis. Turban III.									
Two months before	61.5	13.0	20.5	4.0	..	(37.5)	1.0	..	8,500
At start	70.0	9.5	17.5	1.5	0.5	(29.0)	0.5	5.0	12,000
Continued arm hyperemia:									
One week	42.0	9.5	44.0	3.0	0.5	(57.0)	0.5	0.5	10,000
Two weeks	49.5	6.0	40.0	2.5	1.0	(48.5)	1.0	..	15,000
Three weeks	49.0	7.0	42.0	1.0	0.5	(50.5)	..	0.5	15,000
Four weeks	51.0	8.0	36.0	2.5	0.5	(47.0)	1.0	1.0	12,000
Five weeks	56.0	10.0	43.0	0.5	..	(53.5)	0.5	..	
Arms omitted, hyperemia of one leg this week	56.5	14.0	18.5	6.0	3.5	(42.0)	0.5	1.0	
Arm hyperemia again this week	50.5	12.0	30.0	4.5	1.5	(48.0)	1.0	0.5	
Two weeks	69.5	12.0	13.0	4.0	1.0	(30.0)	..	0.5	
Three weeks	48.0	9.5	32.5	5.5	4.5	(52.0)	..	..	
Four weeks	52.0	14.5	25.5	5.5	2.0	(47.5)	..	0.5	

Miss V. Turban III.

	Polymorphonuclears	Small Lymphocytes	Large Lymphocytes	Large Mononuclears	Transitionals	Total Per Cent. Lymphocytes	Eosinophiles	Mast Cells	Total Leukocytes
Before hyperemia	62.0	6.0	17.0	2.0	3.0	(38.0)	..	..	7,000
" "	70.5	7.0	15.0	4.0	1.5	(27.5)	1.5	1.0	14,000
" "	72.5	6.5	14.0	3.5	1.0	(25.0)	2.5	..	17,000
" "	72.0	7.5	14.0	3.5	2.5	(27.5)	5.0	..	16,000
After two weeks arm hyperemia	30.0	2.5	60.5	3.0	3.0	(69.0)	1.0	..	25,000
After six weeks	50.5	13.5	34.0	2.0	..	(49.5)	0.0	..	25,000
After seven weeks	72.0	0.5	19.5	1.0	..	(25.5)	2.5	..	16,000

It was not possible in all these tests to make total leukocyte counts.

We have previously shown the increase[1] in lymphocytes following Bier's hyperemia, and the following case illustrates this again:

Mr. H.—Tuberculous right knee. Bier's hyperemia applied to right leg thirty minutes daily.

	Polymorphonuclears	Small Lymphocytes	Large Lymphocytes	Large Mononuclears	Transitionals	Total Per Cent. Lymphocytes	Eosinophiles	Mast Cells	Total Leukocytes
At start	64.5	9.0	16.5	4.0	4.0	(33.5)	1.0	1.0	
After one week	61.0	8.5	26.0	3.0	0.5	(38.0)	5.5	..	10,000
After two weeks	48.0	10.0	35.5	4.5	1.0	(51.0)	0.5	0.5	
After three weeks	54.0	15.0	27.5	1.5	0.5	(44.5)	1.0	0.5	
After six weeks	52.0	13.5	28.5	3.0	1.5	(46.5)	1.5	..	
After nine weeks	59.0	8.5	28.5	1.0	1.0	(39.0)	2.0	..	10,000

It was next questioned what the results of a hot mustard foot-bath might be on the blood-picture; theoretically, it was expected similar change would take place. The following is the result of such an experiment on a healthy male adult.*

2.50 P.M.: Leukocytes, 9600; mononuclears, 3216; polymorphonuclears, 6192.

	Polymorphonuclears	Small Lymphocytes	Large Lymphocytes	Large Mononuclears	Transitionals	Total Per Cent. Lymphocytes	Eosinophiles	Mast Cells	Total Leukocytes
	64.5	23.0	8.5	2.0	..	(33.5)	1.0	1.0	..

* The time-honored remedy of cod-liver oil has been shown to produce a digestion lymphocytosis.

3 P.M.: Feet placed in tub hot water kept at 55°–57° C., in which was some mustard, for 1 hour.
4.30 P.M.: Leukocytes, 12,360; mononuclears, 4820; polymorphonuclears, 7292

	Polymorphonuclears	Small Lymphocytes	Large Lymphocytes	Large Mononuclears	Transitionals	Total Per Cent. Lymphocytes	Eosinophiles	Mast Cells	Total Leukocytes
	59.0	28.5	6.5	3.0	1.0	(39.0)	1.0	1.0	..

Total leukocyte change = + 29 per cent.
Total mononuclear change = + 50 per cent.
Total polymorphonuclear change = + 18 per cent.

MARROW HYPEREMIA. EXPERIMENTS ON RABBITS—SERIES I.

Eighteen rabbits were divided into three groups. All rabbits were inoculated on the same day with 0.5 c.c. of standardized bovine tubercle suspension.

Rabbits 1 to 6 served as controls. Rabbits 7 to 12 received daily hyperemia of the hind legs for one hour. A thin rubber tubing was passed across the small of the back and brought around under the groin and along the inner side of the ischial tuberosities, and again to the small of the back, and clamped. We had shown by the following experiment on a normal rabbit that a leukocytosis and lymphocytosis could be produced.

3 P.M.: Leukocytes, 5940. per c.mm.; mononuclears, 4663 per c.mm.; polymorphonuclears, 1129 per c.mm.
3.15: Bandaged about hips.
4.15: Leukocytes, 9996; mononuclears, 7047; polymorphonuclears, 2499.
Total leukocyte increase = + 68 per cent.
Total polymorphonuclear increase = + 127 "
Total mononuclear increase = + 51 "

The rabbits were then kept at rest in a capacious box, and some would lie with their hind legs stretched out, while others remained squatting. It was found difficult to regulate the pressure accurately, and the rabbits would at times get into positions when the femoral artery could not be felt, and there is no doubt that on some days the marrow hyperemia was not so successful as on others.

Rabbits 13 to 18 received each one hour similar hyperemia of their hind legs immediately before the inoculation of the emulsion. They received no further treatment.

The 18 rabbits were kept under identical conditions; they were fed and watered daily at 8 o'clock, and bloods were always taken at 11 o'clock.

The blood examinations were made every third day, and the series 7 to 12, which will be spoken of as the hyperemia group, had the tourniquet applied immediately following the blood-taking.

Theobald Smith,[13] inoculating rabbits into an ear vein with 0.5 c.c. of a

well-clouded suspension of tubercle bacilli in bouillon, killed rabbits weighing between 1300 and 2200 grams in seventeen to twenty-one days. We carefully followed his directions, and the density of our tubercle suspension was nearly equivalent to that of a bouillon culture of typhoid bacilli twenty to twenty-four hours old, and nearly as homogeneous.

In inoculating rabbits 1 to 6 a mistake was made in attempting to use a 10 c.c. syringe. This was found unwieldy, and resulted in rabbits 1, 2, 3, and 6 failing to get their full dose. In spite of this it will be noticed that rabbits 2 and 3 died in a comparatively short time.

In rabbit 4 chart, at the × mark, the left hind leg was found to be quite swollen, and in a condition of chronic hyperemia due to the development of a large groin abscess. This condition kept up for the remainder of the animal's life.

We are indebted to Dr. W. F. Martin, of Colorado Springs, for the report of a patient with pulmonary tuberculosis who showed considerable improvement following the development of a large fibroid uterus which caused venous stasis in the legs.

The culture of the bovine tubercle bacillus used in all our work was obtained through the courtesy of Dr. M. P. Ravenel from Dr. John Reichel, of the Pennsylvania State Live Stock Sanitary Board. It is known in their laboratory as Culture H, and was virulent for guinea-pigs, rabbits, dogs, goats, and cattle. The culture was grown on glycerin-agar.

The following averages for the 18 rabbits were found before the beginning of the experiments:

Average leukocyte count (18 rabbits)		9800 per c.mm.
Average rectal temperature	extremes	6060 to 14630
		= 101.6° F.
	extremes	100.2° to 103.4° F.
Average percentage mononuclears		69
	extremes	54° to 82.5° F.

It was not possible to obtain all males, and it was unfortunate that in the hyperemia group four females were included. These gave birth to litters, as indicated in the charts.

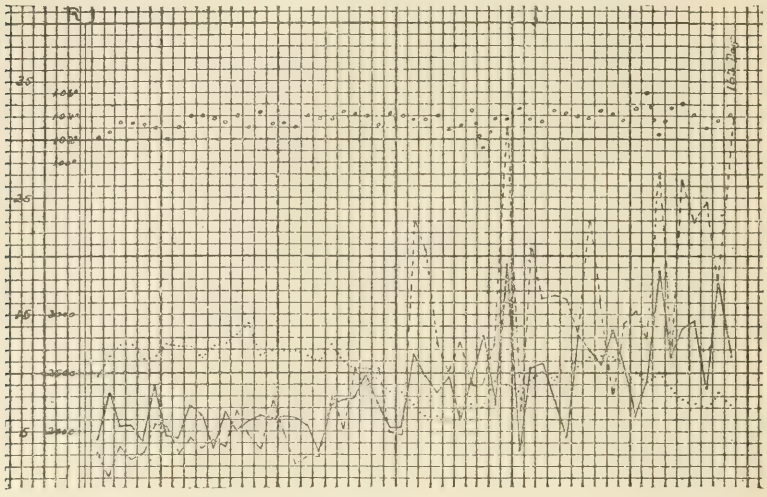
Rabbit 9 gave birth to young, as seen in chart, and this condition was followed by complete inversion and extrusion of the uterus. As this organ could not be replaced, the rabbit was sacrificed on the forty-fifth day.

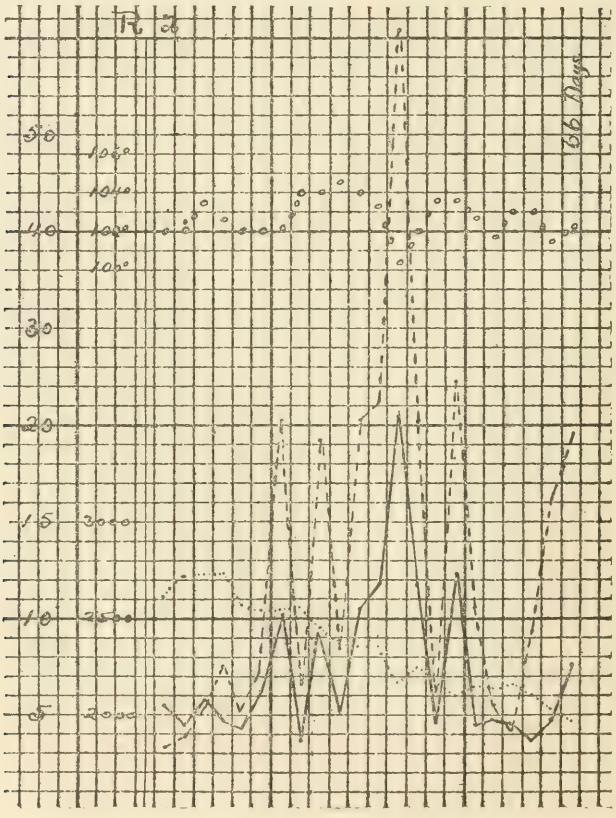
The marrow of normal rabbits was studied macroscopically before and after hyperemia, and of some of the infected rabbits at their death, but on account of the dark-red color already due to the hyperplasia induced by altitude, no difference in color could be detected.

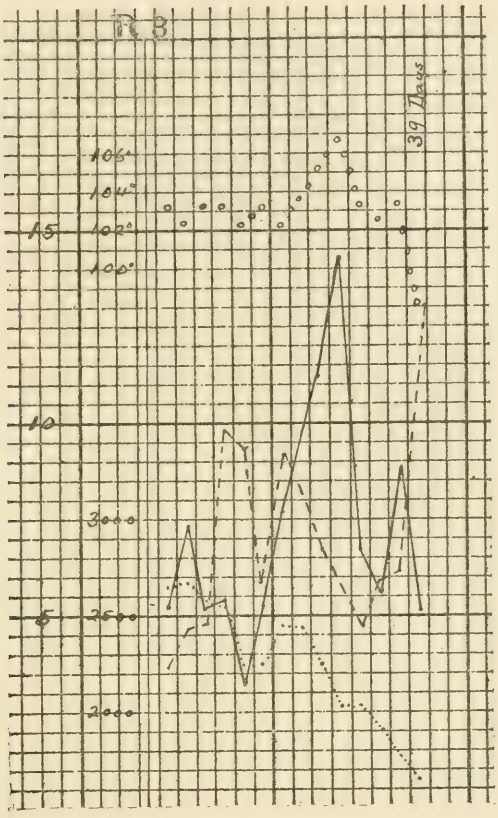
The marrow of rabbits at this altitude (6000 feet) is of a dark-red color, whereas at sea-level it is a grayish red[4] (Josué).

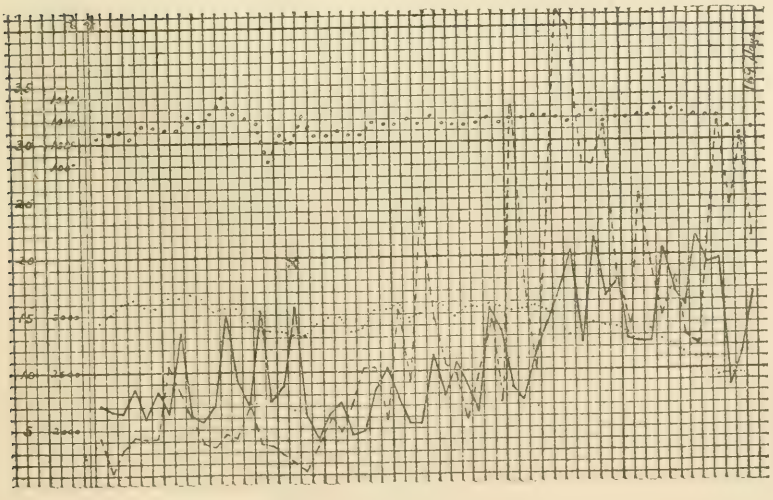
o o o o o o Temperature. – – – – – – Polymorphonuclear leukocytes per c.mm.
———— Total mononuclear leukocytes per c.mm. . . . . Weight in grams.

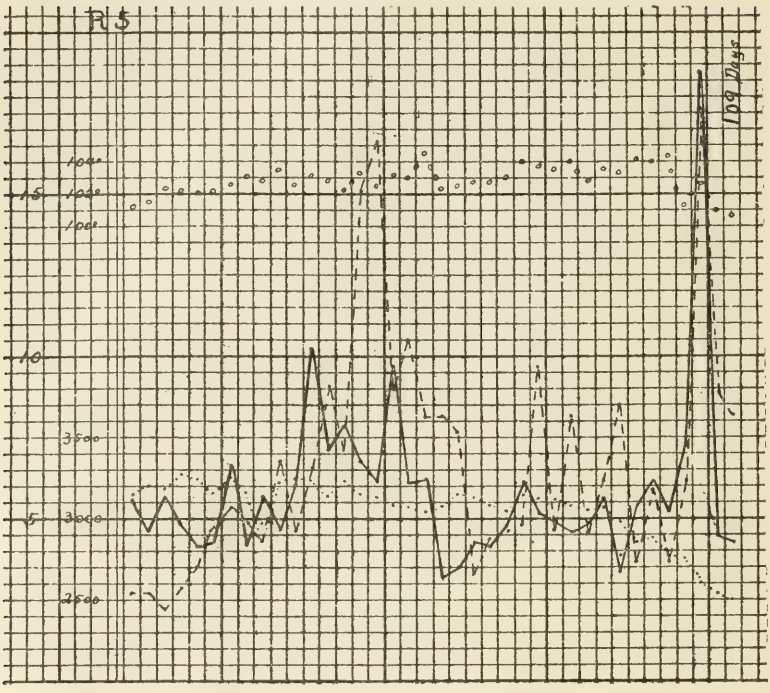
The left-hand column of figures represents thousands per c.mm. The second column of figures represents above temperature, below weight in grams.

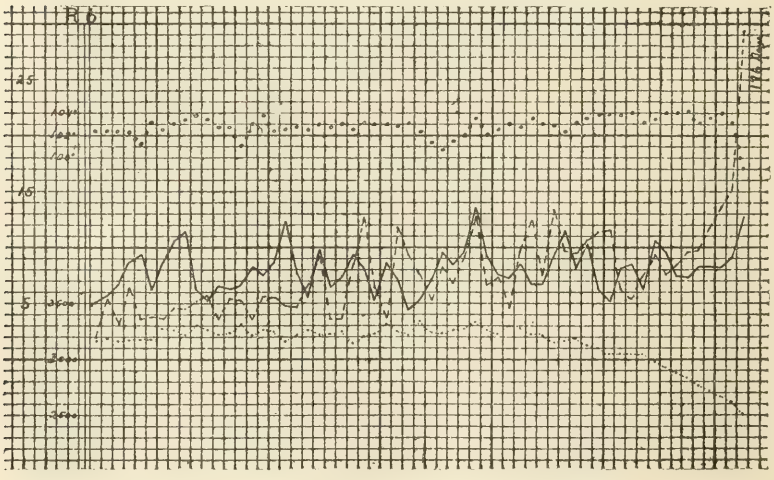


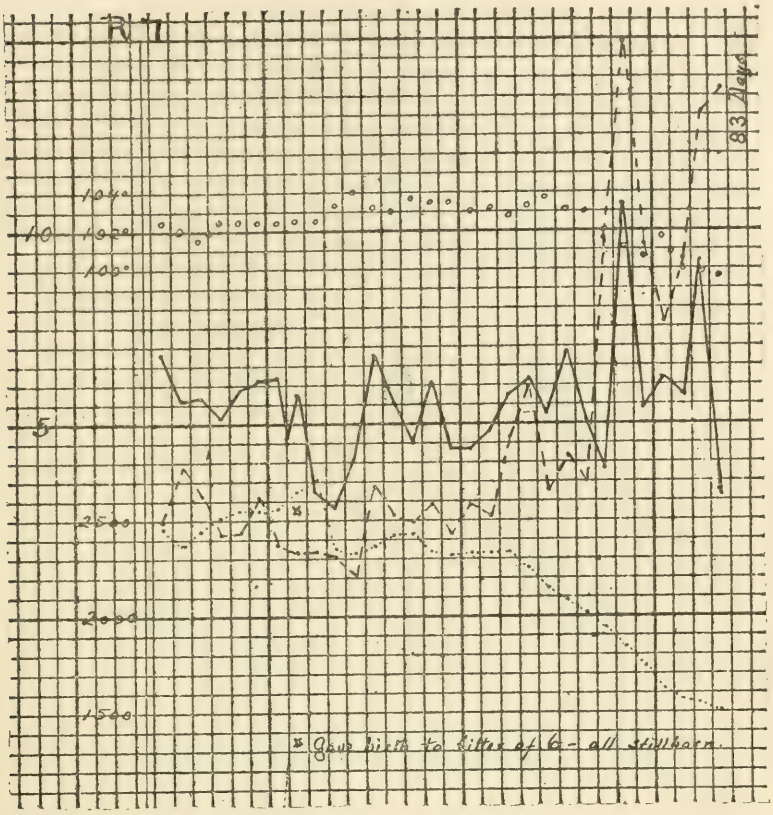


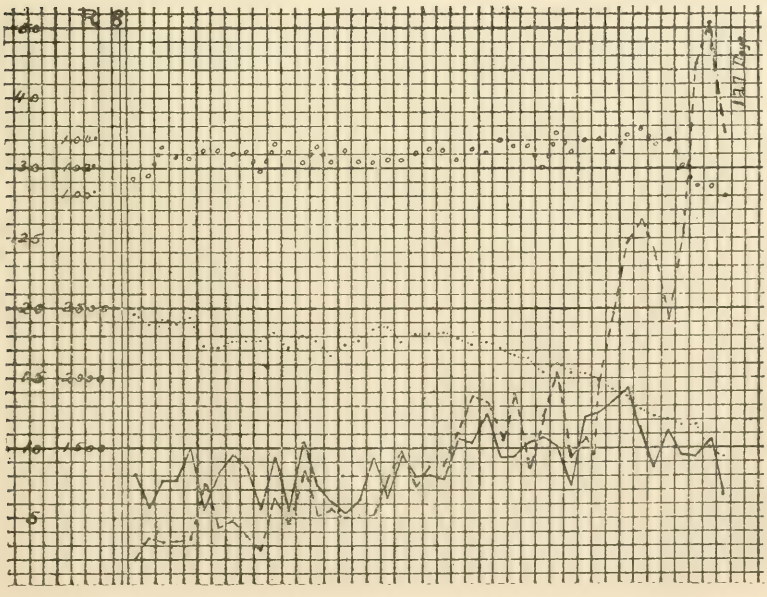

39 Days
105°
104°
103°
102°
101°
100°
15
10
5
30000
25000
20000

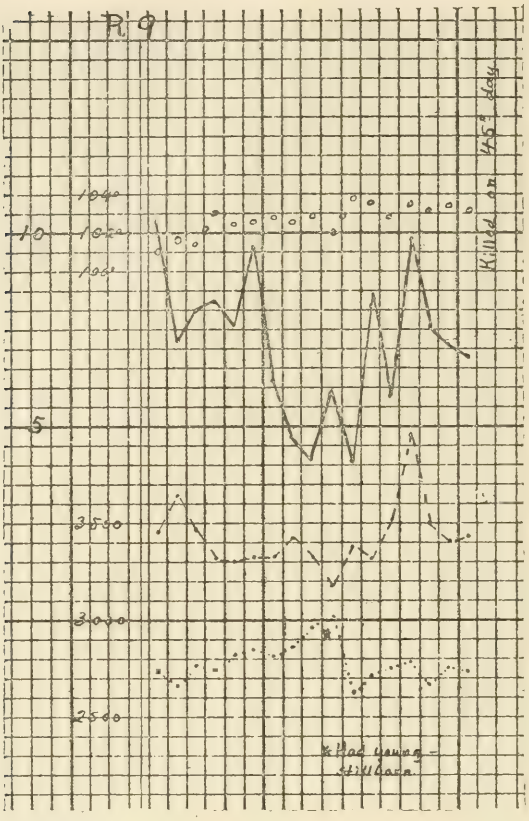


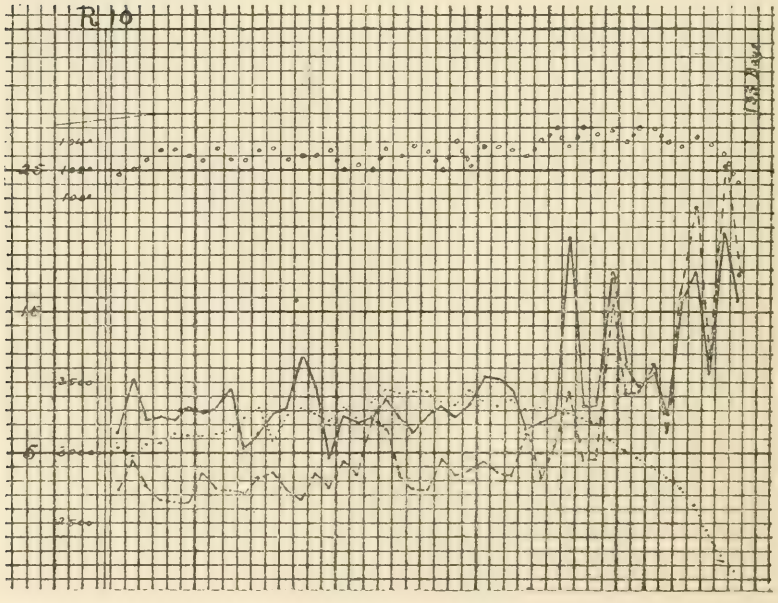

R 5
109 Days
15
10
5
3500
3000
2500

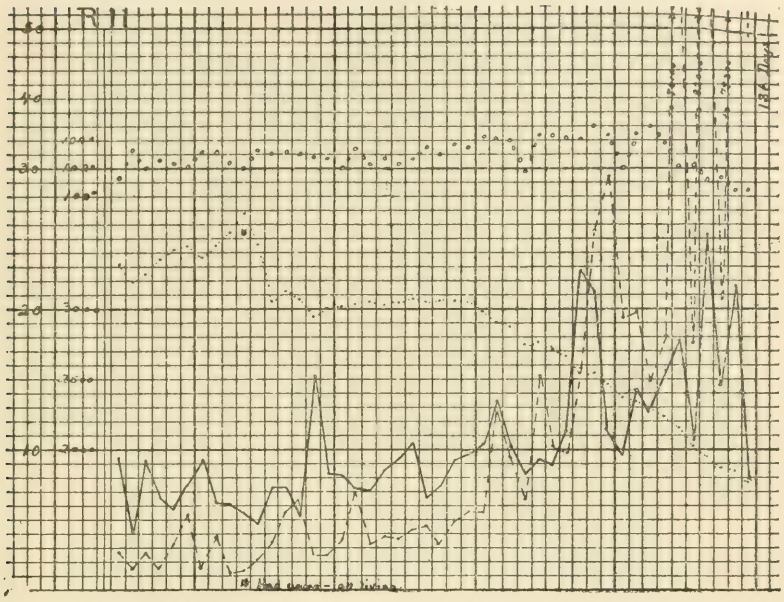

R 6
25
15
5

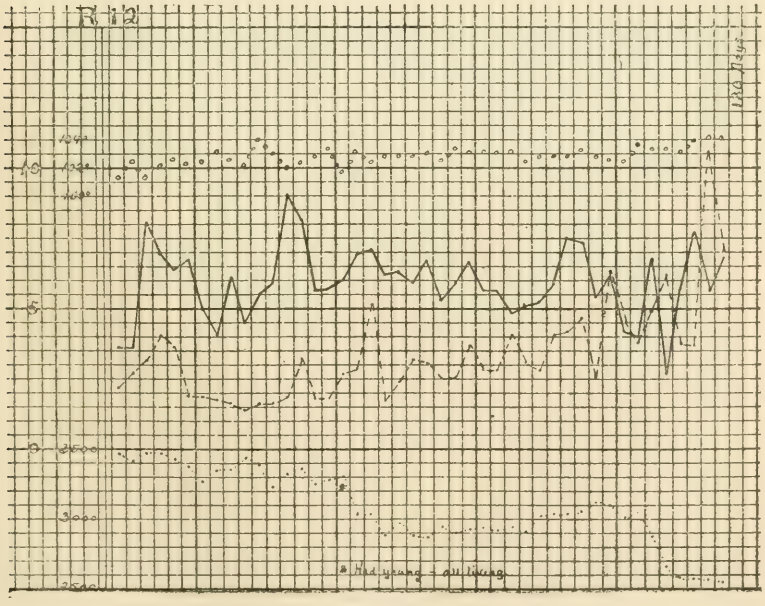

R 7
83 Days
104°
103°
102°
40
30
25
20
15
10
5
* Gave birth to litter of 6 - all stillborn.

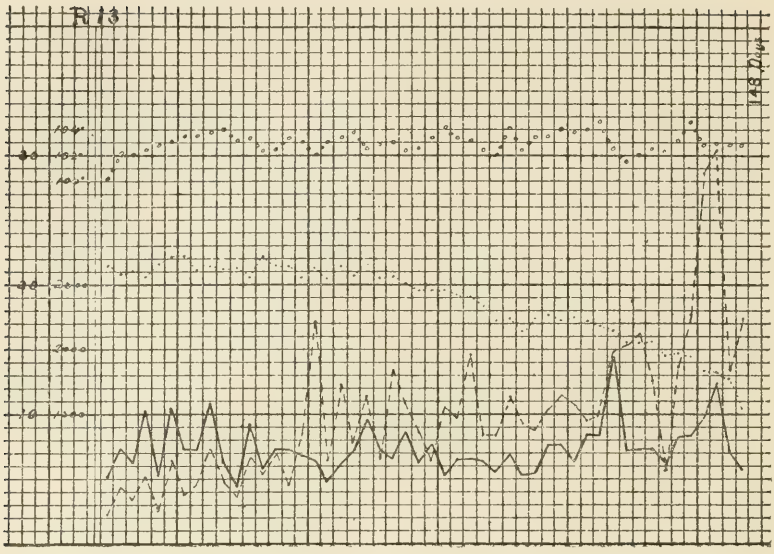

R 8
137 Days
104°
103°
102°
40
30
25
20
15
10
5

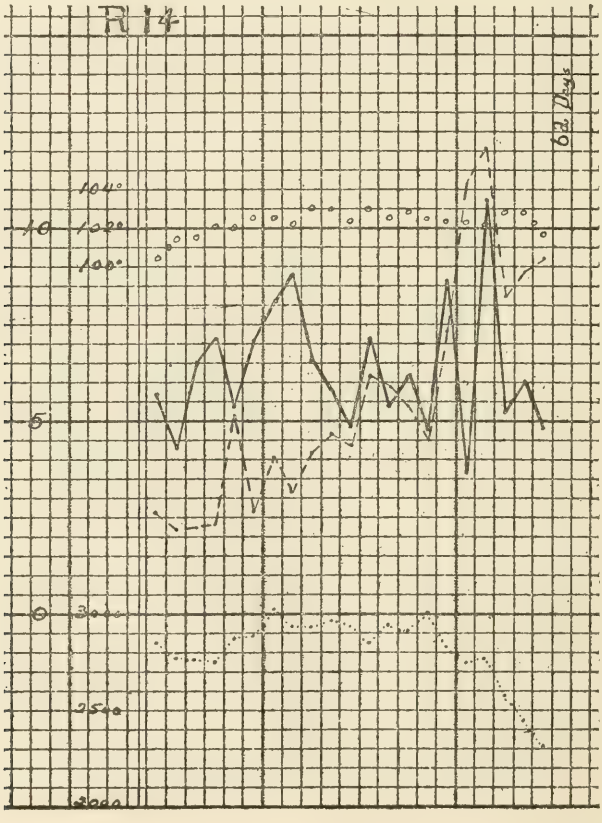

R 9
Killed on 45th day
1040
10
1020
1000
5
3500
3000
2500
* Had vomited - still hoarse

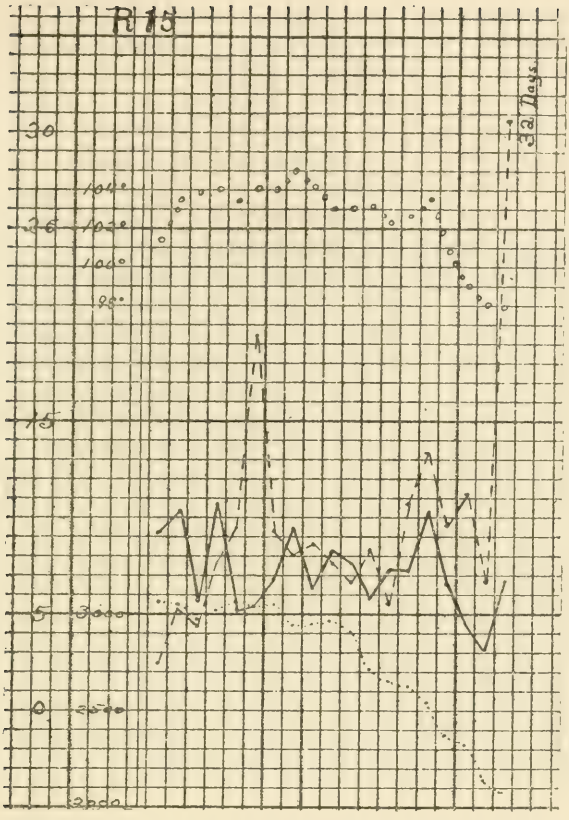

R 10
1040
25
1000
960
10
3500
5
3000
2500

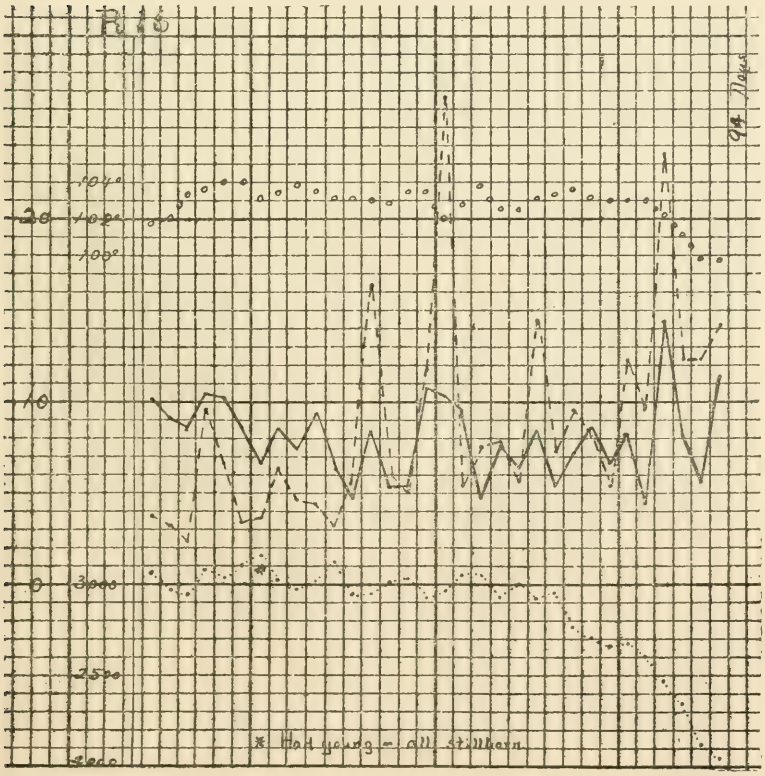

R II
134 Days
Had young = all living

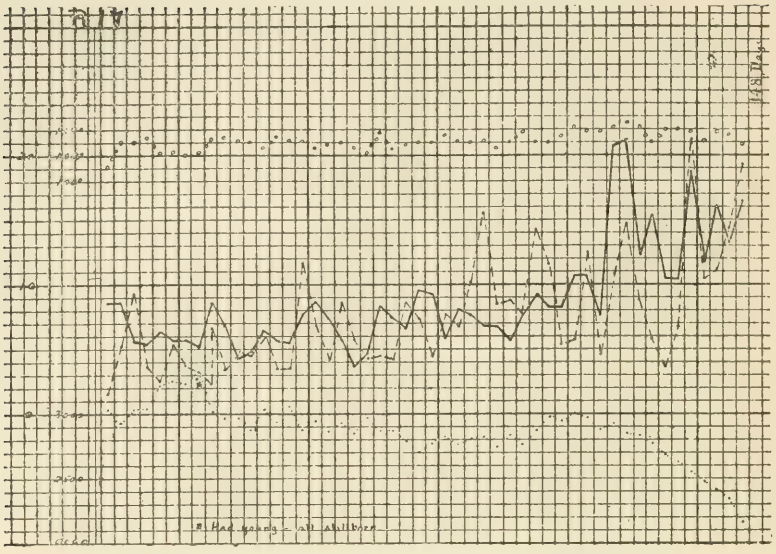

R 12
Had young = all living

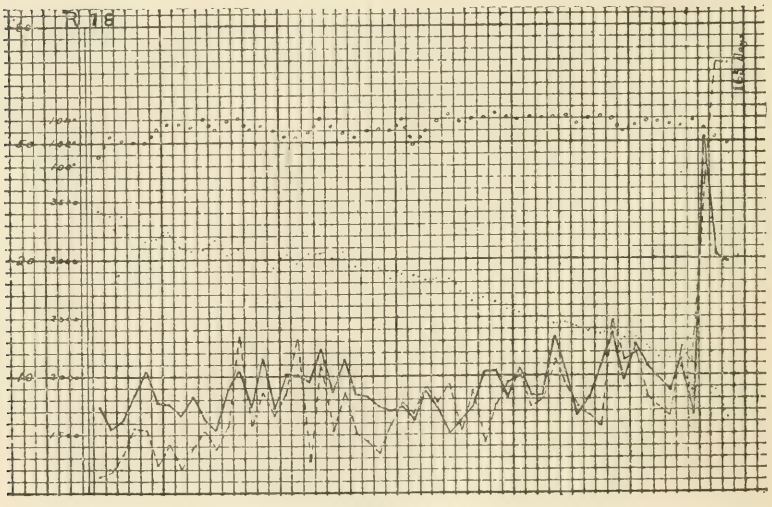

R 13
148 Days


R 14
62 Days


R 15
33 Days.
30
25
20
15
10
5
0
104°
102°
100°
98°
3000
2500
2000


R 16
94 Days.
30
20
10
0
104°
102°
100°
3000
2500
2000
* Hot young = all stillborn





In surveying the eighteen charts, one important impression would seem to stand out in the hyperemia group, namely, the long-continued high level of the lymphocytes and the suppression, until quite late, of marked leukocytosis.

AUTOPSY RECORD OF RABBITS 1 TO 18.

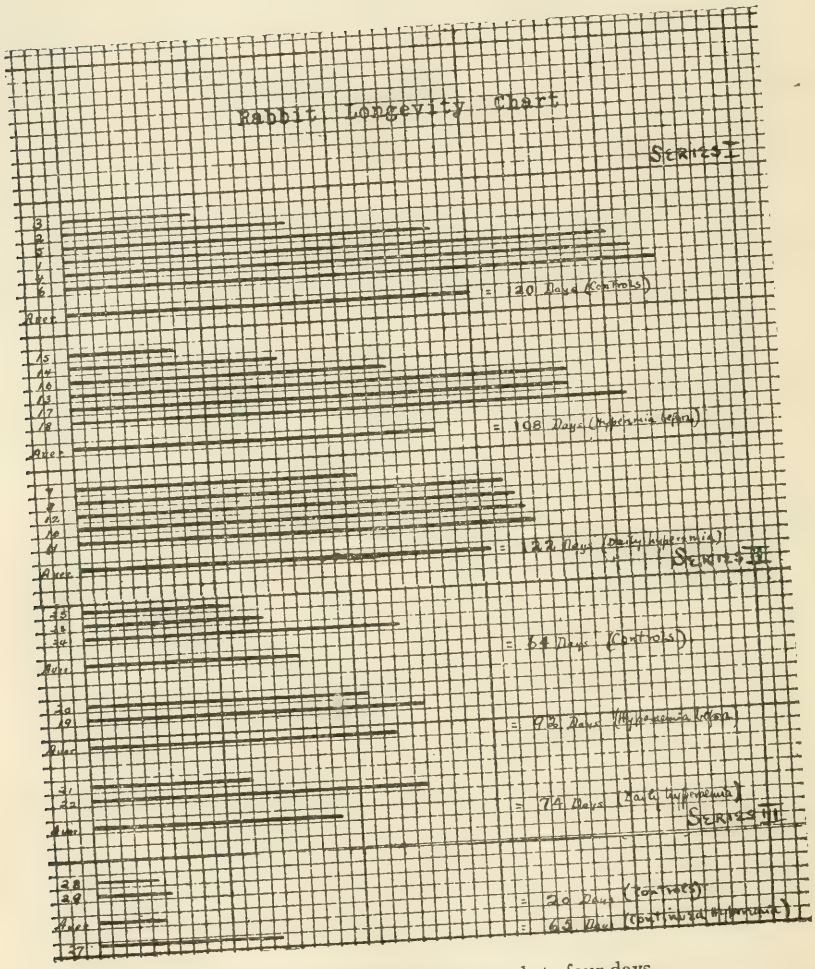
Rabbit	Body Surface	Lungs	Liver	Spleen	Kidneys	Peritoneum	Mesenteric Glands	Inguinal Glands
1	Large abscess left chest-wall.	+ + +	+	+ +	+ +			+
2	Large abscess whole of both sides chest....	+ + +	+ +	+ +	+ +			+ +
3	Ulcers over buttocks. Indurated areas both sides chest and abdomen	+	+			+		+ +
4	Large abscess area left groin.	+ + + left + right	Amyloid	Amyloid	Amyloid left +	+ +		+ +
5		+ +	+ +	+ +				+ +
6		+ + +	+	+ + +				+ +
7		+ + +	+	+ +	+ +	+		+ +
8		+ +	+ +	+ +	+ + +		+	+
9	Uterus completely inverted and protruding following a litter.	Small discrete tubercles						
10		+ +			+			
11		+ +	+		+			+
12		+ +	+ +	+ +	+ +			+ +
13		+ + +	+	+	+ +			+
14		+ +	+ +	+ +	+ +			+ +
15	Left eye destroyed. Pus also from right.	+ +		+	+			+
16		+ + +	+	+	+ + +	+ + +	+	
17		+ +		+	+ +	+ +		+
18		+ + +			+ +			

Explanation of signs: + A few tubercles. + + Moderate tuberculous condition. + + + Advanced and excessive tuberculosis.

Reviewing the autopsy records, it seems curious that four out of the six controls should develop extensive lesions on the body surface, whereas no lesions of this kind occurred in the hyperemia group.

The following red blood-corpuscle averages indicate that the marrow hyperemia also causes an increase in the production of erythrocytes:

Normals—6 counts on 6 rabbits..... .Average, 6,300,000
Normals—4 rabbits after one-half hour hyperemia..... " 8,100,000



In the chart each space corresponds to four days.

INFECTED RABBITS. BLOOD COUNTED SIX WEEKS AFTER INOCULATION

Controls, R. 1, 2, 4, 5, and 6	Average,	6,150,000
Hyperemias, R. 7, 8, 10, 11, and 12	"	9,400,000
Hyperemia before, R. 13, 14, 16, 17, and 18	"	8,100,000

SERIES II. RABBITS 19 TO 25

In this series the rabbits treated with hyperemia were set up in stocks during the application of the rubber to their hind legs. It was thought that by this position better and more certain hyperemia would be provoked. After the first few days one hour was found to be too much for their strength, and the time was shortened to half an hour.

Blood examinations were made daily before and after hyperemia, in rabbits 21 and 22 and the results are shown in charts.

SERIES III. RABBITS 26 TO 31

Rabbits 26 and 27 received continuous hyperemia following the inoculation of the standard dose of bovine tubercle bacilli. Average length of life, sixty-five days.

R. 26, weight	2674 grams
R. 27, weight	2790 "

Rabbits 28 and 29 served as controls. Average length of life, twenty days.

R. 28, weight	1510 grams
R. 29, weight	1550 "

Rabbits 30 and 31 received no inoculation of tubercle bacilli, but served as controls, with only the application of the rubber bands.

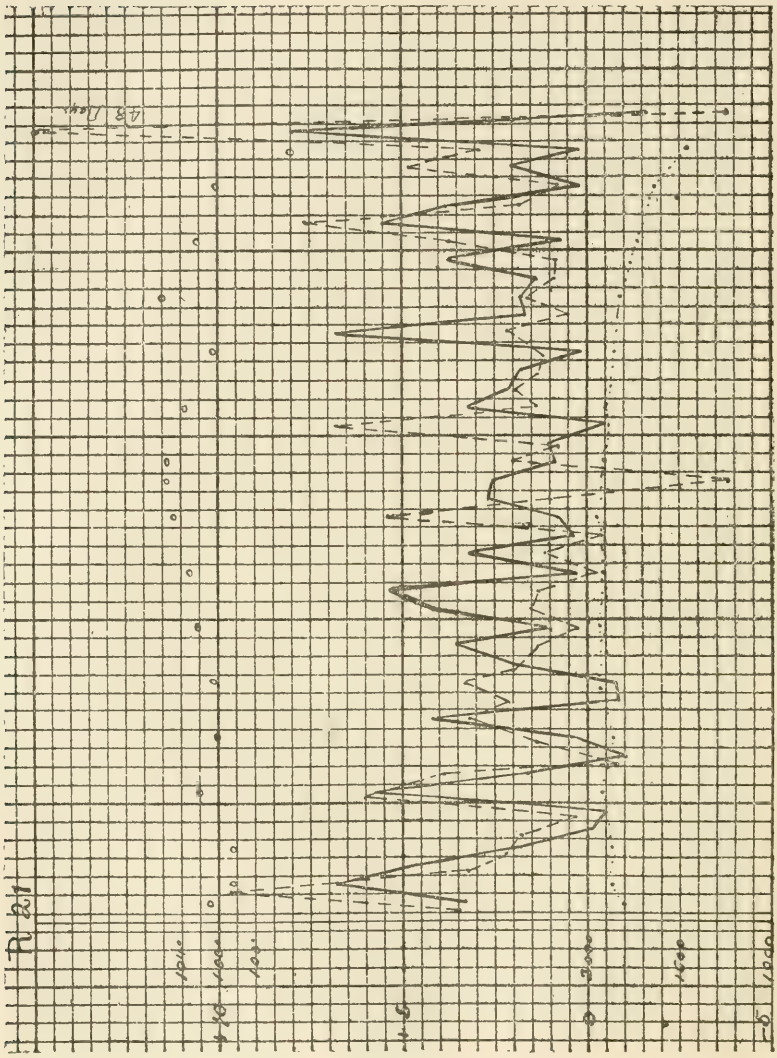
Rabbits 26, 27, 30, and 31 had applied to their forelegs rubber bands circled once around above the shoulders, and the loops then hooked together over the shoulders with a wire, which could be adjusted to tighten and loosen as necessary.

Rabbits 26 and 28 were found dead the same morning.

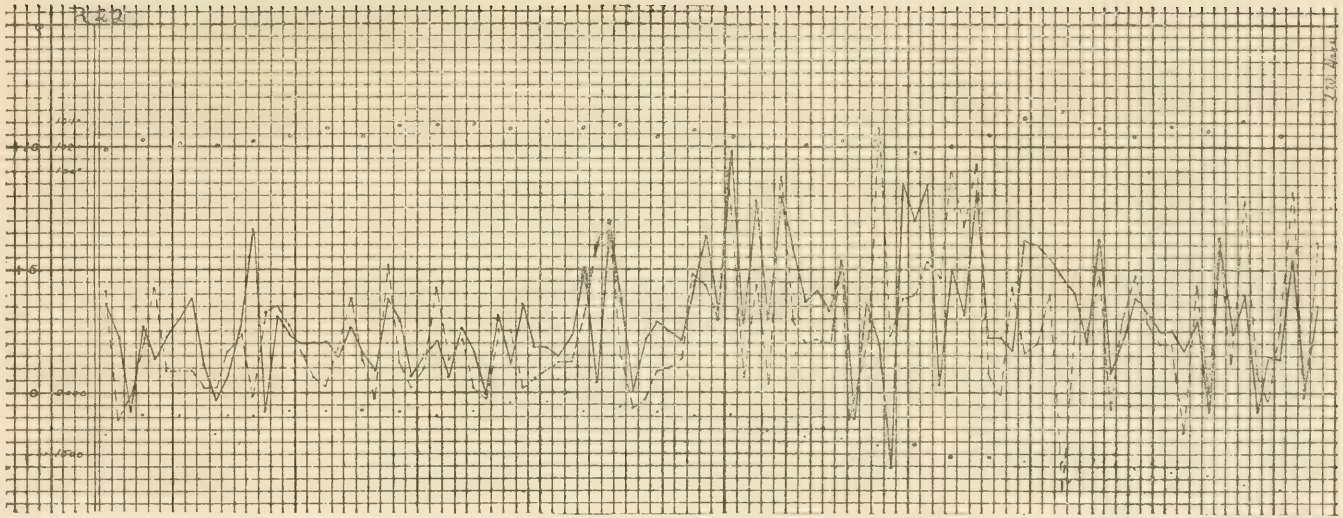
Rabbit 26 had accidentally hung himself to the wire netting of his cage by the wire hook on his back which held together the rubber bands on the legs.

His death was quite unfortunate, yet the contrast between the tubercle condition in the lungs and in those of rabbit 28 was most striking, and decidedly in favor of the continued hyperemia treated rabbit. The autopsy on rabbit 27 is as follows:

Rubber bands in place on upper part of forelegs. Beneath the bands the skin is eroded, and in several places the skin is entirely cut through—no evi-



The chart represents the changes produced among the leukocytes by one-half hour hyperemia, expressed in total numbers of mononuclears (————) and polymorphonuclears (– – – – –) per c.mm. Each space corresponds to one day. For example, on first day, the mononuclears increased 3300 and the polymorphonuclears 3500; on sixth day, mononuclears decreased 500, and the polymorphonuclears increased 300.



Explanation same as Chart R. 21. It is of interest to note that in only 16 of the 144 counts (11 per cent.) included in R. 21 and R. 22 did the hyperemia fail to cause an increase in the number of mononuclears.

dence of any inflammation. The deep veins distal to bands are three or four diameters larger than those proximal.

Heart, liver, spleen, and mesenteric and inguinal glands free from tubercles. Throughout both kidneys, scattered whitish areas.

Peritoneum smooth and glistening. Intestinal mucosa reddened and contents semifluid and brownish.

Marrow of femur examined macroscopically and compared with that of forelegs, but no difference was noted.

The mononuclear and polymorphonuclear leukocytes varied as follows:

	Mononuclears	Polymorphonuclears
Rabbit 26:		
Before infection	15,162 per c.mm.	2,473 per c.mm.
After 7 days continued hyperemia.	8,095 "	2,133 "
" 14 " " "	4,831 "	2,546 "
Rabbit 27:		
Before infection	9,868 "	3,947 "
After 7 days continued hyperemia.	7,114 "	968 "
" 14 " " "	6,947 "	3,422 "
" 21 " " "	6,412 "	4,980 "
" 28 " " "	7,484 "	4,539 "
" 35 " " "	6,145 "	5,719 "
" 42 " " "	6,400 "	7,708 "
" 49 " " "	8,242 "	7,300 "
" 56 " " "	7,728 "	8,904 "
Rabbit 28:		
Before infection	7,568 "	8,448 "
After 8 days continued hyperemia.	5,558 "	3,532 "
" 19 " " "	4,000 "	1,664 "
Rabbit 29:		
Before infection	5,584 "	5,774 "
After 8 days continued hyperemia.	5,177 "	2,588 "
" 19 " " "	29,607 "	30,583 "
Rabbit 30:		
Not infected	4,723 "	2,546 "
After 7 days continued hyperemia.	3,993 "	11,510 "
" 14 " " "	11,404 "	5,875 "
" 21 " " "	5,599 "	4,562 "
" 28 " " "	9,679 "	2,756 "
Rabbit 31:		
Not infected	7,168 "	3,976 "
After 7 days continued hyperemia.	8,193 "	2,958 "
" 14 " " "	7,413 "	4,984 "
" 21 " " "	5,100 "	6,240 "

The marrow considered as an organ has great capacity for increase in territory when actively called upon for the production of more blood-corpuscles. The fatty packing and the cancellous bone can readily be removed, and their

space occupied by proliferating bone-marrow cells when the appropriate stimulus is received.

"Various theories have been advanced to explain the production of inflammatory leukocytosis or the transitory increase of certain of the white cells, occurring in the blood in most of the acute infective diseases, and in other similar conditions. Various chemical substances in solution have been found to attract or to repel certain of the protozoa and to this phenomenon Pfeiffer gave the name chemiotaxis—positive or negative according as the protozoa approach or avoid the substance employed. Pfeiffer also found that bacteria can be similarly influenced by the chemical constituents of nutritive substances, and he and numerous other observers have established the fact that leukocytes can in like manner be influenced by certain bacterial and chemical bodies, positively or negatively as the case may be. This so-called 'chemiotactic action' of bacteria and their products upon leukocytes was found by Leber to be capable of being exerted at a distance, and thus the presence of increased numbers of leukocytes in the circulating blood came to be regarded as due to their being attracted or drawn from the blood-forming organs by positive chemiotaxis; while in the leukopenia or absence of leukocytosis found in typhoid fever and in measles the bacterial products are supposed to exercise a negative or repellant action upon the cells. It is not my intention here to discuss the question of how this increased output of blood elements by the bone-marrow is brought about, except in so far as an explanation may be found in the proliferative and other changes in the tissue which accompany it. Whether this proliferation and increased output of cells are due to direct stimulation of the marrow itself, or are merely a regenerative effort on the part of the tissue in order to replace the cells which have been withdrawn from it, it is extremely difficult to determine; and, again, the question whether the chemiotactic substances bringing about these processes in the marrow are produced by the bacteria themselves, or are derived from the leukocytes destroyed by them, is a problem of considerable difficulty, and it is not unlikely that all the factors mentioned may assist in varying degree in the production of these phenomena.

"Whatever be the nature of the cause of this reaction in the blood-forming tissues, the series of phenomena which accompany, or rather which comprise, the actual process, usually follow a somewhat definite order, and the first phenomenon to appear, whether in marrow which is already red in type or in fatty marrow which is about to be transformed into such active hematopoietic tissue, is an *increased supply of blood to the part*"—Dickson.[11]

It is perhaps, therefore, conceivable that by forcing more blood into marrow

which is inert or suffering from a negative chemiotactic condition, valuable leukoblastic results might be obtained.

However, it must not be forgotten that in many cases of pulmonary tuberculosis a condition of the marrow occurs known as mucoid transformation, which allows of no leukoblastic reaction.

We have applied this principle of marrow hyperemia to some thirty pulmonary patients, nearly all, however, in advanced conditions, when it is more than probable the marrow has been exhausted.

Even in these patients, as shown above, it is possible to completely change the blood-picture.

In three comparatively early cases, however, marked improvement took place. Weight was rapidly gained and sputum disappeared.

Further reports of the application to man will, however, be made later.

If the tourniquet principle be applied, the following precautions must be observed:

(1) The best time for the application is daily at bedtime.

(2) Ten minutes should be the duration of the first treatment, followed by twenty, thirty, forty, and fifty minutes, up to one hour, if the patient can stand it.

(3) Patients must be cautioned never to fall asleep with bandage on.

(4) It is wise to have a second person present during the application.

(5) The rubber bandage should be removed from first one leg and then from the other.

The continued form of hyperemia as described above is probably the better and the application to arms and legs can be alternated.

CONCLUSIONS.

1. It would appear that rabbits at this altitude, which possess 69 per cent. of lymphocytes as against 52 per cent. at sea-level (Brinkerhoff and Tyzzer[14]), live longer than sea-level rabbits, following a standardized lethal dose of virulent bovine tubercle bacilli. This occurrence may help to explain the rarity of human tuberculosis manifesting itself here.

2. Artificial marrow hyperemia seems to produce a genuine lymphocytosis, and this occurrence would corroborate the idea that it is the marrow hyperemia of altitude which causes the increase of lymphocytes noted by us at this elevation.

3. Artificial marrow hyperemia, by producing a lymphocytosis and some leukocytosis, appears to hold in check a rapid bovine tuberculous process in rabbits.

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A STUDY OF THE LEUKOCYTES IN PULMONARY TUBERCULOSIS

(A Preliminary Investigation)

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The present investigation was undertaken to determine whether the leukocytes in cases of pulmonary tuberculosis in a sanatorium a little above sea-level present a constant picture in the various stages of the disease and in accordance with the improvement or retrogression of the patient. We desired to see what are the average proportions of the different white blood-cells in phthisis, before taking up some further studies on the effect upon the blood-pictures of various factors, both physiological and medicinal.

The examinations were made from the blood of the patients in the service of one of us at the Philadelphia Jewish Sanatorium for Consumptives at Eagleville, Pa., situated 600 feet above sea-level.

THE LEUKOCYTES AS A WHOLE

CHART I.—TOTAL NUMBER OF LEUKOCYTES

	Stage I*	Stage II*	Stage III*	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	0	5	2	1	3	3
Average number of leukocytes.....		7840	9400	10000	6477	9533

* The classification of the National Association for the Study and Prevention of Tuberculosis has been used.

Stage I.—Slight initial lesion in the form of infiltration limited to the apex of a small part of one lobe. No tuberculous complications. Slight or no constitutional symptoms. Slight or no elevation of temperature or acceleration of pulse at any time during the twenty-four hours, especially after rest. Expectoration usually small in amount or absent.

Stage II.—No marked impairment of function, either local or constitutional. Localized consolidation moderate in extent, with little or no evidence of destruction of tissue or disseminated fibroid deposits. No serious complications.

Stage III.—Marked impairment of function, local and constitutional. Localized consolidation intense; or disseminated areas of softening; or serious complications.

The leukocytic count, as a whole, in the cases examined, varied little from the normal, and in accordance with no definite rule. The average number in cases progressing unfavorably was greater than that in stationary cases. An improving patient had a leukocytic count of 10,000.

Webb and Williams[1] found no increase in the white blood-cells in Colorado. Holmes,[2] who also worked in Colorado, found no leukocytosis in the pretubercular stage, a very little in the early incipient stage, and slight leukocytosis in the advanced stage of the disease. Craig's[3] results, obtained in the congested district of Philadelphia, agree with those of Holmes.

THE POLYMORPHONUCLEAR NEUTROPHILES

CHART II.—PERCENTAGE OF POLYMORPHONUCLEAR NEUTROPHILES

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	2	5	5	3	4	5
" " observations.	4	7	11	5	6	11
Average percentage....	57%	60.8%	65.4%	59%	65%	63%

The average percentage of polynuclear neutrophiles was 59 in improving cases, 65 in stationary cases, and 63 in cases progressing unfavorably. There were many variations from this, however. One improving patient had 70 per cent. one month and 48 per cent. the next. The average percentage in the first stage of the disease was 57 per cent., in the second stage 61 per cent., and in the third stage, 65.5 per cent.

Holmes in Colorado, Hultgen[4] in Chicago, and Swan[5] and Craig in Philadelphia found corresponding differences in the three stages, those of Swan being the most marked. Webb and Williams found the polynuclear cells in normal persons and in cured cases of tuberculosis less at Colorado Springs than at sea-level, being slightly greater in cured than in normal cases. They were very little below the sea-level normal in improving cases at Colorado Springs, and somewhat above it in stationary cases, and considerably above it in cases progressing unfavorably.

Our few cases of leukocytosis were not always associated with an increase in the percentage of polymorphonuclear cells, two cases with 9800 and 10,000 leukocytes respectively having only 62 per cent. of neutrophiles.

This does not bear out the statements of Cabot,[6] Ewing,[7] and Swan,[5] who believe leukocytosis in tuberculosis to be due to an increase in the polynuclear elements.

ARNETH'S CLASSIFICATION

CHART III.—PERCENTAGES OF NEUTROPHILES ACCORDING TO ARNETH'S CLASSIFICATION

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases	2	5	5	3	4	5
" " observations	4	7	11	5	6	11
Percentage of cells with 1 nucleus	6.5%	4.5%	5.5%	6.0%	5.0%	5.0%
Percentage of cells with 2 nuclei	32.5%	33.5%	29.5%	30.0%	29.0%	31.5%
Percentage of cells with 3 "	47.5%	50.5%	46.5%	50.5%	46.5%	48.5%
Percentage of cells with 4 "	11.5%	10.0%	16.0%	11.0%	17.5%	13.0%
Percentage of cells with 5 "	2.0%	1.5%	2.5%	2.5%	2.0%	2.0%
Percentage of cells with 1 or 2 nuclei	37.0%	38.0%	35.0%	35.5%	37.75%	36.7%
Percentage of cells with 3 or more "	63.0%	62.0%	65.0%	64.5%	62.25%	63.3%

The polymorphonuclear cells were divided into five groups, in accordance with the number of nuclei they contained, as suggested by Arneth. In a number of cases Arneth's subdivision of each class according to the configuration of the nuclei was followed; but this was later abandoned, as the number of cells in each subdivision was too small to be of value unless 500 or 1000 neutrophiles were counted.

The cells containing one and two nuclei averaged between 35 and 38 per cent. in improving and stationary and advancing cases, and in the first, second, and third stages of the disease. Some individual cases varied from this general average. In two out of the three improving cases there was an increase in cells having three or more nuclei. Of the four stationary cases, one exhibited this same tendency and one showed an increase in the cells containing one and two nuclei. Of the cases progressing unfavorably, only two showed an increase in the cells containing one or two nuclei, while two showed a marked decrease in these cells.

Our results are thus at variance with the work of Dluski and Rotzsedihowski,[8] who found in the blood of normal individuals 40 to 55 per cent. of the cells containing one and two nuclei, in improving cases 41 to 54 per cent., in cases getting slightly worse 58 to 68 per cent., and in cases progressing very unfavorably, 75 to 92 per cent. The normal count as given by Arneth is 5 per cent. of cells containing one nucleus, 35 per cent. of those containing two nuclei, and 41 per cent., 17 per cent. and 2 per cent., respectively, of cells containing three, four, and five nuclei.

Our cases may, therefore, be said to have had a diminished percentage of neutrophiles containing two and four nuclei and an increased percentage of cells containing three nuclei.

MONONUCLEAR BASOPHILES

CHART IV.—PROPORTION OF MONONUCLEAR BASOPHILES

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	2	5	5	3	6	5
" " observations	4	7	11	5	4	11
Average percentage	34%	33.5%	29%	34%	29.5%	31%

We have classified basophilic mononuclear cells into: (1) lymphocytes, small and large, and (2) large mononuclear and transitional cells. While we have used this conventional classification, we feel that the small lymphocytes constitute a group apart by themselves. Although in most cases we have included in the same group the large mononuclear and the transitional cells, we do not feel at all certain that they rightly belong to the same class.

Cabot thinks it best at the present time to include the so-called large mononuclear cells, for practical purposes, within the lymphocytic group, as no clinical importance has ever been attached to them and as they make up in the great majority of cases but a few per cent. of all the leukocytes. Da Costa[9] finds it convenient, for practical purposes, to classify together the large forms of the true lymphocytes and the large mononuclear leukocytes, since he believes it impractical to differentiate one from the other in specimens prepared for ordinary clinical examination.

LYMPHOCYTES

CHART V.—PERCENTAGE OF LYMPHOCYTES

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	2	5	5	3	5	5
" " observations.	4	7	11	5	6	11
Average percentage.....	34%	33.5%	28.5%	34%	29.5%	31%

The total number of lymphocytes in the first and second stages of tuberculosis averaged about 34 per cent. The lymphocytes are, therefore, increased in the incipient and moderately advanced cases, being less, though still high, in the far-advanced cases.

Patients that were improving had an average of 34 per cent. lymphocytes. Those whose condition was stationary had, on the average, 29.5 per cent., while those progressing unfavorably averaged 31 per cent. The lymphocytic

count was, therefore, highest in the improving and lowest in the stationary cases.

An increase in lymphocytes in incipient tuberculosis has been noted by Craig and Hultgen, the latter regarding it as essential to a diagnosis of incipient tuberculosis. Cabot, however, states that this comparatively large proportion of lymphocytes is not peculiar to tuberculosis, but occurs in a variety of debilitated conditions. Holmes, on the other hand, found a slightly decreased percentage of young cells in the pretubercular stage and a moderate decrease in early incipiency.

In view of a statement of Cabot that an increased percentage of large and small lymphocytes may be found when the leukocytic count is normal and that when leukocytosis is present we find ordinarily a marked increase in the percentage of polymorphonuclear cells at the expense of the lymphocytes, which latter statement Swan supports, it is interesting to note that a slight degree of leukocytosis in one of our incipient cases and also in a moderately advanced case was associated with a high lymphocytic count.

Craig states that the lymphocytes and large mononuclears show a high percentage in Stage I, the percentage being lower in Stage II, and lowest in Stage III. According to his figures, the decrease from the first to the second stage is 8 among the lymphocytes and 1.7 among the large mononuclears. It is evident, however, that by the terms "lymphocytes," "large mononuclears," and "transitionals," he must designate other cells than those to which these terms are ordinarily applied, as his proportions of these cells differ radically from those of all other observers, he having 8 per cent. of transitionals.

Webb and Williams found the proportion of mononuclear cells in normal adults much higher in Colorado Springs than at sea-level. The proportion was a little less in their cured cases of tuberculosis, still lower in improving cases, though slightly above the sea-level normal. The proportion was still lower in stationary cases, and lowest of all in cases progressing unfavorably, being ten less than the normal at sea-level. The decrease was as marked in the small lymphocytes as in the large lymphocytes, large mononuclear cells, and transitionals, which these authors group together.

CHART VI.—COMPARATIVE PERCENTAGE OF MONONUCLEAR CELLS IN EAGLEVILLE AND COLORADO SPRINGS

	Normal		Improving Cases	Stationary Cases	Advancing Cases
Colorado Springs.....	43.6%	Colorado Springs	38.5%	34.4%	27.5%
Sea-level.....	37.4%	Eagleville.....	34.0%	29.5%	31.0%

Holmes also noted a marked relative decrease in the percentage of young cells in the advanced stage of the disease. He states that, as the tubercular condition becomes more marked and convalescence increases, the percentage of lymphocytes increases.

LARGE MONONUCLEAR AND TRANSITIONAL CELLS

CHART VII.—PERCENTAGES OF LARGE MONONUCLEAR AND TRANSITIONAL CELLS GROUPED TOGETHER

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	2	5	5	3	4	5
" " observations	4	7	11	5	6	11
Average percentage....	6.25%	4.5%	5.5%	6%	4.5%	5.5%

Grouping together the large mononuclear and the transitional cells, we obtained an average of 6.25 per cent. in Stage I, 4.5 per cent. in Stage II, and 5.5 per cent. in Stage III. These cells are apparently most numerous in the first stage and least in the second.

Among improving cases the average of these cells was 6 per cent., among stationary cases, 4.5 per cent., and among retrograding cases, 5.5 per cent., highest in the improving and lowest in the stationary cases. We have been unable to find in the hands of other writers any separate record of these cells with which to compare our figures.

In a few cases we counted separately the large mononuclear cells and the transitionals, with opposite results.

CHART VIII.—PERCENTAGE OF LARGE MONONUCLEAR AND OF TRANSITIONAL CELLS, GROUPED SEPARATELY

	Stage I		Stage II		Stage III		Improving Cases		Stationary Cases		Advancing Cases	
	Large mon.	Trans.	Large mon.	Trans.	Large mon.	Trans.	Large mon.	Trans.	Large mon.	Trans.	Large mon.	Trans.
Number of Cases	1	1	3	3	1	1	1	1	2	2	2	2
Number of observations..	1	1	3	3	1	1	1	1	2	2	2	2
Average percentages.....	2%	3%	3%	2%	2.7%	2.3%	2%	3%	4%	2%	2%	2%

The transitionals showed the largest percentage in the first stage and in improving cases, and the lowest in the second stage and in stationary cases, but the large mononuclears showed the reverse. The large mononuclears averaged

2, 3, and 2 per cent., in the first, second, and third stages, respectively, and 2, 4, and 2 per cent. in improving, stationary, and advancing cases, respectively. The transitionals, on the contrary, averaged 3, 2, and 2.3 per cent. in the first, second, and third stages, respectively, and 3, 2, and 2 per cent. in improving, stationary, and advancing cases.

Craig's figures show the smallest percentage of transitionals also in the second stage (6.4 per cent.), but the largest was in the third stage (8.6 per cent.).

POLYNUCLEAR BASOPHILES

In examining our blood preparations we noticed a number of basophilic cells with multiple nuclei. As a rule, we skipped them without recording their presence. Several times we included them with the polymorphonuclear neutrophiles, thinking that they belonged to that group, but had failed to take the stain well. The study of several fields, however, in which these new cells and true polymorphonuclear neutrophiles lay side by side, convinced us that they belonged to different types of cells. One we classed with the transitional cells. We tend to the opinion that they belong to the same group as the transitional cells. The structure of the cell protoplasm and of the nucleus in the one closely resembles that of the other. We, moreover, observed in one field two cells—one a typical transitional, the other a similar cell having a crescentic nucleus divided in half, with a very narrow space between the two segments. The nucleus in the polynuclear basophile is comparatively large in size, and is of even configuration and staining qualities. As many as three nuclei have been observed in one cell, superimposed one above the other. In our future work we shall group these cells separately.

EOSINOPHILES

CHART IX.—PERCENTAGES OF EOSINOPHILES

	Stage I	Stage II	Stage III	Improving Cases	Stationary Cases	Advancing Cases
Number of cases.....	2	5	5	3	4	5
" " observations	4	7	11	5	6	11
Average percentages...	1.5%	0.75%	1.3%	1.2%	1.2%	1.1%

The average percentages of eosinophiles in our cases in the first, second, and third stages were 1.5, 0.75, and 1.3 respectively. The first stage, however, represents but four counts, two of which had none and one had 4 per cent.

Of six counts in the second stage, three had none and one had 0.5 per cent. There was only one zero among nine counts in the third stage.

The improving and the stationary cases averaged 1.2 per cent., while those progressing unfavorably averaged 1.125 per cent.

Craig's figures differ from ours in that the greatest percentage of eosinophiles (3.4 per cent.) occurs in the second stage, while the lowest (1.8 per cent.) is in the third stage.

Webb and Williams found the largest percentage of eosinophiles in the cured cases of tuberculosis, the next lowest in order being normal cases, improving cases, stationary cases, and advancing cases. Swan, in his earlier work, as well as in that with Karsner, found an increase in eosinophiles to accompany improvement under treatment. Their absence he considered an unfavorable prognostic sign.

CONCLUSIONS

It is, of course, impossible to draw any definite conclusions from so few observations as have been presented in this paper. Some of the results are, nevertheless, suggestive.

In our cases: 1. The percentage of polymorphonuclear neutrophiles was diminished in incipient and moderately advanced cases, being less in the former. It was also diminished in cases that were improving.

2. The percentages of the different forms of polymorphonuclear neutrophiles, classified according to the number of nuclei they contained, bore no constant relation to any stage or to the progress of the disease.

3. The percentage of lymphocytes was increased in incipient and moderately advanced and in improving cases.

4. The percentage of large mononuclear and transitional cells, grouped together, while within normal limits, was greatest in incipient and in improving cases.

5. The percentage of eosinophiles was greatest, though normal, in incipient cases.

6. In moderately advanced cases were found the lowest percentage of large mononuclear and transitional cells, grouped together, and of eosinophiles, and the highest percentage of large mononuclear cells.

7. In patients whose condition was stationary occurred the highest percentage of polymorphonuclear neutrophiles, and the lowest percentage of lymphocytes, of large mononuclear cells, and of large mononuclear and transitional cells grouped together.

8. Whenever one extreme was exhibited by moderately advanced cases (as in 6) or by stationary cases (as in 7), the other extreme was furnished respectively by incipient cases or by improving cases. Far-advanced and retrograding cases respectively held a middle position, which approached the condition found in incipient and in improving cases respectively, rather than the other extreme.

IMPROVING CASES

No.	Stage	Date	Total Count	Polymorphonuclear	Lympho-cytes	Large Mon. and Trans.	Eosino-philes
1	I	3- 6-10	..	70% (Arneth's classification) I. 7% } 42% II. 35% } III. 44% } IV. 14% } 58% V. 0% }	24%	4%	2%
1	I	4- 3-10	..	48% (Arneth's classification) I. 4% } 31% II. 27% } III. 64% } IV. 5% } 69% V. 0% }	44%	8%	0
2	I	3- 6-10	..	56% (Arneth's classification) I. 6 % } 35.5% II. 29.5% } III. 41.5% } IV. 17 % } 64.5% V. 6 % }	32%	8%	4%
2	I	4-10-10	..	60% (Arneth's classification) I. 9% } 50% II. 41% } III. 40% } IV. 9% } 50% V. 1% }	35%	5%	0
3	II	4-17-10	..	62% (Arneth's classification) I. 3% } 21% II. 18% } III. 64% } IV. 10% } 79% V. 5% }	34%	4%	0
3	II	4-24-10	10,000				

STATIONARY CASES

No.	Stage	Date	Total Count	Polymorphonuclear	Lympho-cytes	Large Mon. and Trans.	Eosino-philes
4	II	2-13-10	..	62% (Arneth's classification) I. 5.5% } 33.5% II. 28 % } III. 44.5% IV. 17 % } 66.5% V. 5 %	30%	6%	2%
4	II	4-10-10	..	64.5% (Arneth's classification) I. 8% } 35% II. 27% } III. 42% IV. 22% } 65% V. 1%	29%	6%	0.5%
4	II	4-24-10	6,000				
5	II	4-10-10		70.5% (Arneth's classification) I. 7% } 56% II. 49% } III. 37% IV. 7% } 44% V. 0%	23%	4.5%	2%
5	II	4-24-10	6,200				
6	II	4-10-10		62% (Arneth's classification) I. 0% } 28% II. 28% } III. 60% IV. 12% } 72% V. 0%	34%	4%	0
6	II	4-24-10	7,200				
7	III	1- 6-10		62% (Arneth's classification) I. 6% } 34% II. 28% } III. 41% IV. 21% } 66% V. 4%	32%	4%	2%
7	II	2-27-10	..	68% (Arneth's classification) I. 6% } 40% II. 34% } III. 44% IV. 15% } 60% V. 1%	28%	3%	1%

ADVANCING CASES

No.	Stage	Date	Total Count	Polymorphonuclear	Lympho-cytes	Large Mon. and Trans.	Eosino-philes
8	II	4- 3-10	..	42% (Arneth's classification) I. 0% } 29% II. 29% } III. 71% IV. 0% } 71% V. 0%	54%	4%	0
8	II	4-10-10	..	62.5% (Arneth's classification) I. 7% } 63% II. 56% } III. 34% IV. 3% } 37% V. 0%	31%	3.5%	3%
8	II	4-24-10	9,800				
9	III	2-27-10	..	68% (Arneth's classification) I. 6% } 35% II. 29% } III. 41% IV. 21% } 65% V. 3%	26%	5%	1%
9	III	3- 6-10	..	72% (Arneth's classification) I. 6.5% } 37.5% II. 31 % } III. 45.5% IV. 16 % } 62.5% V. 1 %	29%	5%	2%
9	III	4-10-10	..	65% (Arneth's classification) I. 7 % } 50.5% II. 43.5% } III. 38.5% IV. 10.5% } 49.5% V. 0.5%	29%	5%	1%
10	III	2- 6-10	..	66% (Arneth's classification) I. 6% } 31% II. 25% } III. 44% IV. 19% } 69% V. 6%	30%	3%	1%
11	III	2- 6-10	..	67% (Arneth's classification) I. 7% } 34% II. 27% } III. 46% IV. 17% } 66% V. 3%	28%	4%	1%

ADVANCING CASES—(*Continued.*)

No.	Stage	Date	Total Count	Polymorphonuclear	Lympho-cytes	Large Mon. and Trans.	Eosino-philes
11	III	4–10–00	..	78% (Arneth's classification) I. 7% } 21% II. 14% } III. 54% IV. 20% } 79% V. 5% }	24%	8%	0
11	III	4–24–10	10,400				
12	III	2– 1–10	..	54% (Arneth's classification) I. 4.5% } 40.5% II. 36 % } III. 45.5% IV. 13 % } 59.5% V. 1 % }	32%	10%	4%
12	III	3–20–10	..	60% (Arneth's classification) I. 3 % } 36.5% II. 33.5% } III. 44 % IV. 14.5% } 63.5% V. 5 % }	35%	4%	1%
12	III	4–10–10	..	60% (Arneth's classification) I. 3% } 25% II. 22% } III. 67% IV. 8% } 75% V. 0% }	30%	8%	2%
12	III	4–24–10	8,400				

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DISCUSSION ON PAPERS BY DR. WEBB AND DR. SOLIS-COHEN

Dr. W. L. Moss, Baltimore: I should like to ask Dr. Webb what he found to be the normal variation in the differential and total counts in his rabbits. Dr. Brown and myself have recently been making some blood studies, and we have found some rather wide variations where counts were made at different hours of the day. I should like also to ask him if he has made any counts to determine how long this altered relationship keeps up. As I understand it, he has made his counts from ten minutes to half an hour after the termination of the period of hyperemia. I would also like to know how long increased lymphocytosis keeps up, and whether he thinks new cells are formed during that period, or whether it is simply a difference in distribution of the cells?

Dr. Joseph Walsh, Philadelphia: I would like to ask whether they have made any investigations on chronic heart disease, with passive congestion, to see whether there would be any lymphocytosis in such cases?

Dr. G. B. Webb: We did the work on the rabbits as carefully and thoroughly as we could. Each group of rabbits was weighed, their temperatures taken, and their bloods counted every third day. The rabbits were fed always at the same time of day and received the same quantities of food and water. As far as we can tell the increase of lymphocytes following hyperemia keeps up just over twenty-four hours.

We feel that there is a genuine increase in the number of new lymphocyte cells. On account of the marrow hyperplasia already present at our altitude we could not see macroscopically any difference between the marrow of the bones treated with hyperemia and the untreated.

Blood examinations of our normal rabbits always show small numbers of nucleated red corpuscles, and there was no increase in these following hyperemia; we have, however, frequently found lymphocytes apparently undergoing mitosis, and it was not infrequent to see large lymphocytes containing three or four nuclei. Only on one occasion in man following hyperemia did we find nucleated reds.

There does not seem to be any relationship between the state of nutrition and the lymphocyte count in Colorado. Some of the thinnest people have a

high lymphocyte count, averaging 50 per cent., whereas when they arrived from sea-level they would have only from 30 to 35 per cent.

Replying to Dr. Knopf, the rectal temperature was recorded accurately every three days. In rabbits, however, suffering with bovine tuberculosis, the toxic effect of the disease as measured by the thermometer does not seem to be of much moment. Rabbits do not appear to die of toxemia, but more from the mechanical effect of the disease, the organs, such as the lungs, being found so crowded with tubercles that they cannot functionate.

Dr. Walsh's point is very important. I do not know of any observations on lymphocytes in cases of heart disease; we have not made any, as valvular lesions with us are very infrequent. Dr. Sewall, of Denver, thinks there may be a connection between the marrow hyperplasia of altitude and the overcrowding of the right heart which he reported some years ago.

Dr. Webb: In regard to Dr. Minor's remarks, I would like to say a word. A year ago, when we were working out the effect of altitude on the lymphocytes, we took the occasion, during 500 differential blood counts, to study the nuclei of the polymorphonuclear cells according to Arneth's scheme. We also obtained the index according to the suggestion of Bushnell and Treuholz.

While we thought the study of the number of nuclei might be of some value, it seemed to us that the simple differential count gave a better basis on which to form a prognosis. Arneth's method lacks a definite standard. Variations in the determination of the Arneth index in a number of observations on a healthy man, made by the same worker, gave such wide variations that we felt we could get no reliable standard.

It is doubtful, anyway, what part the polymorphonuclear cells play in the defense against tuberculosis. They would certainly appear not to play the chief part, and we feel sure, from our work, that when they increase in numbers, the fight against the tubercle bacillus is being lost.

Dr. Joseph Walsh, Philadelphia: Even in an ordinary case, there is usually some rapidity of the heart-beat, and, I should think, practically always a certain amount of passive congestion is the result of heart weakness.

Dr. Webb: In such cases as Dr. Walsh refers to there is not an increase in the number of lymphocytes particularly. There may be an increase in the polynuclears and some increase of the lymphocytes also, but no relatively greater increase of lymphocytes.

Dr. Myer Solis-Cohen: In answer to the questions asked, I may say that some of our cases that were losing weight had high lymphocytosis, one case having as high as 54 per cent. and a number of the cases 34 and 35 per cent.

Dr. Charles L. Minor, Asheville: Mr. Chairman, as I did not hear the

papers read, I can only judge of the contents of the papers by their titles, but the subject interests me a great deal, and I would like to say a few words with reference to Dr. Arneth's method, which I have used rather extensively for somewhat over a year. A year ago I reported that I had found the method useful and valuable for arriving at a prognosis. Since that time, for a number of months, I have had opportunity to use it in my clinical work. As I said in a paper which will be published shortly, to avoid unintentional influencing of judgment, I have had the laboratory work done by an assistant ignorant of the identity of the case being investigated, and I am more and more struck with the remarkable coincidence of the clinical course with the expectations derived from the evidence furnished by Arneth's method; and I have concluded that a rising Arneth's index is indicative of a bad prognosis, a falling index, of good prognosis.

I would urge that the method be tried extensively. It is not difficult, though it requires painstaking and careful blood work. There is no unanimity of opinion about the value of the method, and certainly it would be well to reach a definite conclusion. My study of several hundred cases justifies me in recommending a more extended study of the method throughout the country.

Dr. Webb: In regard to Dr. Minor's remarks, when we were working out the effect of altitude in counting the lymphocytes, we also worked out about 500 observations on the Arneth index and on Arneth's idea of the division of the nuclei. While we thought it was of some value, it seemed to us that the differential count gives a better basis on which to form a prognosis. The great difficulty with the Arneth method is the lack of a definite standard. It is doubtful what part the polynuclears play in tuberculosis. They probably play some part, it is true; but that they play the whole part on which you can hang a prognosis is very doubtful. Variations in the determination of the Arneth index in a number of observations on a healthy man, made by the same worker, gave such wide variations that we felt that we could not get any standard, and we felt that the differential lymphocyte count was very much better, as regards prognosis, than anything we could get from a study of the Arneth indices.

Dr. E. R. Baldwin, Saranac Lake: I have been very much interested in Dr. Webb's study, and it seems as if it promises to give an explanation of the rationale of the beneficial effects of altitude in the treatment of tuberculosis as differentiated from all other influences.

Chairman: Dr. Webb has referred to the dose of tubercle bacilli producing death in rabbits in twenty-one days, and it seems that I will have to answer that question before the section. There is, perhaps, nothing

so difficult as to get a uniform period of life following the injection of a fatal dose of tubercle bacilli. We all know that tubercle bacilli degenerate slightly from the time they are first cultivated, and it is very difficult to determine the time when animals will die from a given dose. I assume that the doses referred to were of bacilli grown on glycerin-agar. If we take a very virulent strain of bovine bacilli, one that has just been isolated and grown on blood-serum, we do get, as Dr. Webb said, death very early; the tubercle bacilli multiply so rapidly in the lungs that the tissues practically fill up with tubercles and the animal dies of asphyxia, often in twenty-four hours after signs of illness; that is to say, the day before death we are hardly able to say that the animal is really diseased after cursory examination. There is a certain stage, however, in the cultivation of tubercle bacilli when this does not hold—after the bacilli have become what might be called "saprophytized" by continued cultivation. They are no longer so able after a time to resist lysis in the body of the rabbit, and it frequently happens that at the end of a certain number of weeks an animal dies of intoxication, probably as a result of the sudden setting free of a large amount of toxin, causing pulmonary congestion and edema. When we examine such rabbits we frequently find that the tubercles present in the lung are not sufficiently numerous to warrant death, as compared with those cases in which a more virulent type of bovine bacilli was used. There are, thus, two modes of death, and it is very difficult to say that an animal will die at a certain time when it receives a certain dose of tubercle bacilli. I believe I sent the culture to you, Dr. Webb?

Dr. Webb: No; I wrote you about it and suggested to you that it would be a good thing to do at some time, but this culture was obtained from Dr. Reichel, of Philadelphia.

Chairman (Continuing): The most rapid death is produced by the bovine bacilli cultivated on blood-serum. As soon as they are cultivated on glycerin-agar they lose a certain amount of their virulence.

Dr. Webb: Ours had been on yolk of egg with glycerin-agar.

Chairman: It is really one of the most difficult things to create a standard which we can say will remain such for any length of time in determining curative or immunizing effects.

THE GROSS PATHOLOGY IN FATAL CASES OF TUBERCULOSIS OF THE LUNGS

By Joseph Walsh, M.D.
Philadelphia

The points that I have endeavored to bring out are, first, the actual cause of death of a number of cases which had tubercle bacilli in the sputum and were supposed to have died of tuberculosis of the lungs; second, the amount of involvement in the lungs and the frequency of cavities, in other words, what we might expect to find in an advanced case; and, third, the primary location and progression of the disease in these cases in order to show what class or classes of cases give a bad prognosis.

THE CAUSE OF DEATH IN SEVENTY-FIVE CASES

Acute tuberculosis of both lungs	20
Chronic tuberculosis of the apices, acute tuberculosis of the rest of both lungs	2
Acute tuberculosis of both lungs and intestines	5
Acute tuberculosis of lungs and amyloid disease of abdominal organs	1
Acute tuberculosis of both lungs and acute nephritis	1
Chronic tuberculosis of left lung, acute tuberculosis of right lung	8
Acute tuberculosis of right lung	2
Acute tuberculosis of right lung and intestines	1
Chronic tuberculosis of right lung, acute tuberculosis of left lung and intestines	2
Acute tuberculosis of left lung	1
Chronic tuberculosis of right lung, acute tuberculosis of left lung, dilatation of heart, and chronic interstitial nephritis	1
Chronic tuberculosis of both lungs	9
Chronic tuberculosis of both lungs, amyloid disease of liver	1
Chronic tuberculosis of both lungs, hypertrophy of heart, and chronic parenchymatous nephritis	1
Acute tuberculosis of larynx, intestines, and both lungs	2
Laryngeal ulceration with inanition	1
Tuberculosis of intestines, chronic tuberculosis of left lung, acute tuberculosis of right lung	1
Chronic right pyothorax, chronic tuberculosis of right lung, acute tuberculosis of larynx and intestines	1
Acute right pyothorax and chronic and acute tuberculosis of right lung	1
Left pyothorax and tuberculosis of left lung	1
Right pyopneumothorax and tuberculosis of lungs	2
Left pyopneumothorax and tuberculosis of lungs	3
Acute tuberculosis of right lung, almost healed left pyothorax following pyopneumothorax	1

Acute tuberculosis of lungs and recent but not fatal acute left hydropneumothorax..... 1
Acute tuberculosis and gangrene of both lungs and recent but not fatal left pneumothorax 1
Atheroma with aortic aneurism, very slightly active, chronic tuberculosis of right lung, and practically cured right pyopneumothorax..... 1
Atheroma with two aortic aneurisms, very chronic, scarcely active tuberculosis of the tops of both lungs..... 1
Hypertrophy of heart, diffuse nephritis, slightly active tuberculosis of right lung..... 1
Hypertrophy of heart, chronic parenchymatous nephritis, tuberculosis of left upper lobe. 1
Chronic endocarditis, chronic interstitial nephritis, amyloid liver, spleen, and kidneys, and slightly active tuberculosis of right lung..... 1

Or considering the one most important cause of death in these seventy-five tuberculous cases we have:

Acute tuberculosis of both lungs	31	(41.33%)
Acute tuberculosis of right lung	12	(16.00%)
Acute tuberculosis of left lung	4	(5.33%)
Chronic tuberculosis of both lungs	11	(14.66%)
Acute tuberculosis of larynx	3	(4.00%)
Tuberculosis of intestines	1	(1.33%)
Pyothorax	3	(4.00%)
Pyopneumothorax	5	(6.66%)
Arteriosclerosis with aneurism	2	(2.66%)
Heart and kidney disease	3	(4.00%)

In this enumeration of the causes of death we have included only the conditions which appear to have been especially operative in causing death in the individual case. Many more of these cases, for instance, showed tuberculosis of the intestines than here indicated, but this condition appeared to have had little or no influence in directly producing the death. In this series the percentage of pyopneumothorax ran high, the ordinary percentage being about 5 per cent. I might add that two of the pyothorax cases appeared capable of recovery if the pyothorax had been operated upon. The three heart and kidney cases and the two cases with arteriosclerosis and aneurism had so little tuberculosis that it had little or no influence on death, yet they all showed tubercle bacilli in the sputum. It is to be noticed that the recognition of the tubercle bacillus has permitted cases of this character to be reckoned in the mortality tables as tuberculosis when in reality they died of other causes.

AVERAGE AMOUNT OF INVOLVEMENT AT DEATH IN SIXTY-FIVE CASES

Right lung	0.67
Left lung	0.69
Both lungs	0.68
Smallest amount of involvement in both lungs	0.11
Largest amount of involvement in both lungs	0.95

In considering the average amount of involvement at death we omitted all ten pyothorax and pyopneumothorax cases, because after the development of these conditions the lung covered by them almost always becomes secondarily

involved as a consequence, and this involvement does not belong to the natural and ordinary progress of the disease. The table shows that, as a rule, about two-thirds of each lung is involved at the time of death.

The death of the patient with the smallest amount of involvement (Phipps Institute Case No. 7663) was due to inanition from failure to eat on account of a very painful ulceration of the larynx and epiglottis. The case was also interesting on account of having general arteriosclerosis with marked atheroma of aorta and locomotor ataxia when the tuberculosis developed. The locomotor ataxia followed a syphilis of fifteen years before.

The case with the largest amount of involvement was as follows: Case No. 3798. Male. Age, thirty-two. American. Occupation, telegraph lineman. No history of contagion. No previous diseases. Duration of illness, according to patient, six and one-half years; first symptom, stomach trouble. Tubercle bacilli were found in the sputum five years before death. Height, 5 feet, $10\frac{3}{4}$ inches. Highest weight, 173 pounds nine years before death; after death, 88 pounds.

Pathological Diagnosis: Obliteration of both pleuræ, chronic and acute tuberculosis of both lungs, tuberculosis of spine, tuberculous ulceration of intestines, slight atheroma of aorta, amyloid liver, sago spleen, enlargement and anthracosis of bronchial glands, tuberculosis of mesenteric glands and tuberculous epididymitis. Cause of death: Acute tuberculosis of both lungs.

The progression of the disease appears to have been: Tuberculosis of spine, of left upper lobe, left lower lobe, then right lung, from top to bottom, at once and simultaneously tuberculosis of the intestines. It appears to have been a rather typical left-sided case, in which the disease slowly but continuously progressed without check.

CAVITIES AT DEATH IN THE SAME SIXTY-FIVE CASES

Cavities in right lung	54	(83.08 %)
Cavities in left lung	52	(80.00 %)
Cavities in both lungs	44	(67.69 %)
Cavities in right lung alone	10	(15.38 %)
Cavities in left lung alone	8	(12.31 %)
No cavities in either lung	3	(4.61 %)

CAVITIES IN DIFFERENT PARTS OF THE LOBES

Left lung:	Upper lobe upper part	51	(78.46 %)
	Upper lobe lower part	34	(52.30 %)
	Lower lobe upper part	30	(46.15 %)
	Lower lobe lower part	11	(16.92 %)
Right lung:	Upper lobe	51	(78.46 %)
	Middle lobe	21	(32.31 %)
	Lower lobe upper part	27	(41.54 %)
	Lower lobe lower part	4	(6.15 %)

This division of the different lobes into parts was made to follow clinical divisions on the chest. The upper part of the left upper lobe extended from the apex to the base of the lobe posteriorly, and to the third rib anteriorly; the lower part from the third rib to the base anteriorly. The upper and middle lobes on the right are considered to about correspond with the upper and lower parts respectively of the left upper lobe. The upper part of the lower lobe extended from the base of the upper lobe posteriorly to the angle of the scapula, and the lower part to the base of the chest.

FREQUENT INVOLVEMENT IN FATAL CASES

In 59 cases that showed rather typical and frequent lesions the distribution of the lesions was as follows:

Large cavity or several medium-sized cavities, taking up most of the upper lobes to the fourth rib and scattered tubercles below	13
Left upper lobe either one large cavity or series of cavities, left lower lobe series of small to medium-sized cavities with fibrosis; right upper lobe large cavity; rest of right lung few or many scattered tubercles	9
Left upper lobe one large cavity or series of medium-sized ones; lower series of medium-sized cavities; right lung few to many scattered tubercles	9
Cavities right upper lobe; right middle lobe, apex right lower lobe and apex left upper lobe, with scattered tubercles below	8
Practically no cavities; fibrosis at both apices and few or many scattered tubercles below	7*
Right upper lobe large cavity, middle and lower lobes slight fibrosis and scattered tubercles; left lung scattered tubercles	6
Small cavities irregularly distributed throughout both lungs, with caseation on one side and fibrosis on the other	4
Small cavity at each apex, with few or many scattered tubercles below	3

PROGRESSION OF THE DISEASE

Out of 75 cases, 30 gave no indications whatsoever on which to base a progression. In all these 30, both lungs were involved in such a fashion that it was impossible to decide which part of the lungs was affected first. In 45 cases, however, there were indications of the progression. In these 45, eight showed disease only on the right side, and eight additional so little disease on the left, and this so acute in comparison with the right, that there was no doubt but in these sixteen the disease began on the right. Seven showed the disease only on the left side, and four additional so little disease on the right, and this so acute in comparison with the left, that there was no doubt but in these eleven cases the disease began on the left. In addition there were nine others in which

* In a previous table we showed but three cases without cavity formation, while here we speak of seven. The discrepancy arises from the fact that in the former instance we reckoned even the smallest cavity as a cavity, while here we omit four which were at least so small that there would be no question of recognizing them clinically.

it was probable that the disease began on the right and three others in which it was probable that the disease began on the left. Finally, there were six in which it was probable that the disease began at the top of both lungs simultaneously or nearly so and progressed down both at the same time.

Of the sixteen cases in which the right lung was undoubtedly involved first, the right upper lobe was the seat of primary location ten times, the lower lobe the seat of primary location once, and the exact seat of primary location was undiscovered five times, though it was evidently in the right lung. Of the ten cases in which the primary location was in the right upper lobe the lower lobe was the seat of secondary location twice, the middle and lower lobes simultaneously seven times, the left upper lobe once. Of these right-sided cases the whole lung appears to have been involved about simultaneously five times.

Of the eleven cases in which the left lung was undoubtedly involved first, the upper lobe was the seat of primary location eight times, and the exact seat of primary location was undiscovered three times, though it was evidently in the left lung. Of the eight cases in which the upper lobe was the seat of primary lesion the secondary lesion was in the left lower lobe seven times, and once the disease did not progress beyond the upper lobe. In the other three cases the whole lung was involved almost simultaneously.

Of the nine cases in which it was probable that the disease began on the right the upper lobe was the seat of primary location in all. In these nine cases the secondary location was in the middle lobe four times and in the left upper lobe five times.

Of the three cases in which it was probable that the disease began on the left, the upper lobe was the seat of primary location twice, and once the disease appeared to develop in both lobes simultaneously. Of the two cases in which the primary location was in the left upper lobe, the secondary location was in the right upper lobe both times.

In other words, in those 45 cases in which the progression was reasonably evident fourteen began in the right lung and advanced all through the right lung before the left became diseased; eleven began in the left lung and ten advanced all through the left lung before the right lung became diseased, the remaining one not progressing beyond the upper lobe. Or adding together the positive and probable cases, 29 progressed throughout one side before the other was involved, and six progressed down both simultaneously. Of the remaining ten, two were practically confined to one lobe, and eight progressed from one upper lobe to the other upper lobe. Putting these statistics in tabular form we have:

PROGRESSION IN FORTY-FIVE CASES

Both lungs from above downward simultaneously	6
Right upper lobe to right middle lobe	4
Right upper lobe to right lower lobe	2
Right upper lobe to right middle and lower lobes	7
Three lobes of right lung simultaneously	5
Right lower lobe alone	1
Right upper lobe to left upper lobe	6
Left upper lobe to left lower lobe	7
Left upper lobe alone	1
Both lobes of left lung simultaneously	4
Left upper lobe to right upper lobe	2

If anything can be concluded from this small number of statistics, it would appear that the most fatal cases are those which advanced down one side, and the least fatal cases those that heal more or less on one side and produce the secondary involvement on the other side. I realize, however, an almost fatal fallacy in these progression statistics, namely, that the cases progressing from one upper lobe to the other upper lobe are particularly the ones in which, after a time, it would be very difficult to judge the progression, and there were 30 such cases.

In the discussion last year of the paper on "The Development of Tuberculosis" the question was asked where the pleura stood in relation to the progression of the disease, and whether or not it became diseased independently of the lung or simply with the lung. From a study of 65 cases with this point in view, we found that disease of the pleura corresponded with disease of the lung in 41 cases, was less in sixteen cases, and was greater in eight cases. In other words, disease of the pleura seems usually to progress with and follow the disease in the lung.

DISCUSSION ON DR. WALSH'S PAPER

Chairman: I would like to ask Dr. Walsh a question concerning the case which he referred to as starting in the apex of one lung and then passing down and not skipping across. May not such extension of the disease have been due to gravity which opposed the gradual immunizing of the body through the original lesion, and may not the other lung have been partly immune to a fresh attack? May not the situation perhaps be explained in this way, that there was increasing immunity, but that that increasing immunity was interferred with by the tendency of the infected secretion to carry tubercle bacilli into the lower lobes and to flood them therewith?

Dr. J. H. Lowman: I would like to ask Dr. Walsh if he has had opportunity to observe in different generations whether the parent and the child had the

lesion on the same side, on the ground of the old Brehmer theory, that there is a localized diminished resistance which may be hereditary, and that that is the reason the lung is attacked at that particular point. This idea of localized diminished resistance may explain also why the progression is straight down one side. There have been observed instances in which several members of one family have been attacked by lupus, the disease starting at identical spots on each individual.

Dr. McCoy: I would like to ask Dr. Walsh, with respect to prognosis, whether in his opinion an extensive lesion of the apex of the left lung is more favorable to the longevity of the patient than a similar lesion on the right side? also whether the disease is most apt to be transmitted from the right side to the left or from the left to the right?

Dr. L. Rosenberg: I would like to ask Dr. Walsh whether his findings were clinical or at the autopsy table, because it would make quite a difference in my acceptance of his views. If they were found at the autopsy board, they are convincing; but if Dr. Walsh takes the stand that clinically tuberculosis confined to one side causes death without involvement of the other side, and that such a course is common, this runs counter to my experience. I have rarely seen a case of progressive tuberculosis where there was not involvement of both sides.

Dr. S. A. Knopf: Clinically, it is well known that pulmonary tuberculosis begins most frequently at the right apex. As far as the prognostic gravity of a bilateral or a unilateral lesion is concerned, it would seem to me that the prognosis depends largely upon the extent of the involvement. A bilateral lesion may be so limited in extent that we may consider it much more favorable than when the pathological process, right or left, has already invaded the entire upper lobe. I should like to know Dr. Walsh's opinion on this point.

Dr. J. Walsh: In relation to Dr. Theobald Smith's question as to whether or not the lesion may progress downward on account of gravity, I do not know. I never thought of gravity in this connection, but always believed that the lesion progressed on account of local susceptibility.

I have another paper before the Clinical Section in regard to the prognosis of very large lesions in which some of my clinical experience is included. I tried to confine this paper entirely to pathological findings. I find, clinically, two varieties of cases—cases in which the lesion at the top of the right lung progresses gradually, it may be slowly or rapidly, straight down one side; and cases in which the primary lesion heals or half heals. In these latter cases if, for any reason, let us say due to the patient running down, the disease breaks out again, it breaks out not immediately under the healed lesion, but at the

top of the other lung. In other words, the healing of the primary lesion creates more resistance on that side than on the side which never had a lesion. This might be called the theory of localized resistance.

The reason why I say that the prognosis in a case with a very large lesion on one side and a small cured lesion on the other is better than in a case with a large lesion on one side alone is not that two lesions *per se* give a better prognosis than one, but that the cured lesion shows you that the patient at least has had definite resistance to the disease, and this resistance may be built up again; in other words, the cured lesion gives you a definite knowledge of the patient's previous powers.

In relation to Dr. Knopf's remarks, I was very much pleased to have Dr. Knopf confirm my belief that clinically tuberculosis begins more commonly at the top of the right lung. It is remarkable the number of pathological papers that have been written to disprove this, of which the most notable recent one was by Adami and McCrea before the International Congress on Tuberculosis.

Dr. Lowman's question in relation to the hereditary location of lesions is very interesting, and I think there might be something in it. I have never had the opportunity of studying, postmortem, children of tuberculous parents whose postmortems I have seen. Moreover, the only fact I have noticed, clinically, is that the susceptibility to tuberculosis in a particular family is frequently at about the same age. When I find an individual, therefore, who has had several brothers die of tuberculosis at about a particular age, I am ready to attribute more significance to symptoms occurring about that time.

In reply to Dr. Rosenberg, I would say that my paper is based on pathological statistics only.

In answer to the question as to the criteria on which the age of the lesions was based I would say, the common criteria of fibrosis, cavity formation, caseation, and small tubercles. In a number of cases, however, these lesions are so distributed that it is impossible to say in which lung the disease began, and sometimes even how it progressed in one lung. For this reason 30 cases out of 75 had to be omitted from the study. In the remaining 45 the indications were so evident that I cannot believe any one would find objection. For instance, when a lung shows near the top a large cavity with fibrous tissue about it, fibrous tissue and caseation below, and the base studded with tubercles, no one will question the fact that the tuberculosis began at or near the top of the lung, and gradually progressed to the base; now, if the other lung shows only a few scattered tubercles, the entire progression is beyond argument. Practically, all the cases comprised in this study were as evident as this, the doubtful cases being omitted.

THE RELATIVE IMPORTANCE OF THE BOVINE AND HUMAN TYPES OF TUBERCLE BACILLI IN DIFFERENT FORMS OF HUMAN TUBERCULOSIS

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Assisted by
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Introduction.—The idea that part of the tuberculous disease in man was to be traced to infection from cattle had its beginnings in the early part of the nineteenth century. Specific attempt at proof was first made by Klenke in 1846, who insisted upon the infectiousness of milk from tuberculous cattle. The results of the inoculation experiments culminating in the positive demonstration, by Villemin, in 1865, of the infectious nature of tuberculous material from both man and cattle for other animals, strengthened this view. With the discovery of the tubercle bacillus by Koch in 1882 the unity of tuberculous disease in man and the lower animals was apparently settled. Although differences in virulence were noticed in material from man and cattle, and had been noticed even before the discovery of the tubercle bacillus, they raised no doubt as to the complete identity and intercommunicability of the disease. The first step toward separation of varieties among tubercle bacilli was taken when Rivolta and Maffucci showed that the avian tubercle bacillus differed in many ways from the mammalian type. In 1896 Theobald Smith published a study of two cultures, one from a pet animal (*nasua narica*), presumably infected by its tuberculous owner, the other from a tuberculous bull. As a result of the differences noted he concluded that more evidence as to the identity of

* The material furnished us has come chiefly from the Babies, St. Mary's and Memorial Hospitals. The Foundling Asylum and the Post-Graduate Hospital furnished some additional cases. Our sincere thanks are due to Dr. Holt and Dr. Heminway for the Babies Hospital material and to Dr. Dowd for the surgical material. The material from the pulmonary cases was furnished by the Metropolitan and Riverside Hospitals.

bacilli from bovine and human sources was needed. It is an interesting fact that, on the examination of these two cultures alone, he determined every essential difference between the two types. He published further evidence in 1898 of the existence of a human and bovine type of bacillus.

In looking backward over the development of this knowledge as to the existence of varieties it is peculiar that Koch should not have noticed these differences in his original work. This, however, is probably due to the fact that, in the endeavor to prove the causal relationship of the tubercle bacillus to tuberculosis, quantitative differences were lost sight of. The careful comparative work of Vagedes in 1898, which was done under his direction, seems not to have raised any doubts as to the identity of the bacillus from man and cattle, though the possibility of different types was in his mind and probably the incentive of this investigation.

In the face of the growing evidence of varietal differences, little doubt was entertained as to the infectiousness of the bovine virus for man. Much work was being done during this time on the infectiousness of milk from tuberculous cows, and the proportion of tuberculosis in man which could be considered of intestinal origin. Further, many cases were reported of infection from tuberculous cattle on the evidence furnished by the probable source of infection and the type of disease. The cases of accidental inoculation with the bovine virus in postmortem work and under other conditions were considered final evidence.* The simple procedure of investigating the type of bacillus isolated from different forms of tuberculosis and by observation of cultural and virulence characteristics in comparison with known cultures to determine the source of infection, as advised by Smith, received little attention. Interest in the question suddenly became acute with the sensational announcement of Koch in 1901. The prominence of the man, and the startling character of his conclusions, which were practically a reversal of his original views, aroused interest in the subject. The statements he made were as follows:

"In view of all these facts I believe that I am justified in maintaining that human and bovine tuberculosis are not identical, and that the human variety cannot be transferred to cattle. . . . But how about the susceptibility of human beings to bovine tuberculosis? This question cannot be answered directly, since, of course, experiments on human beings are not permissible; but we can get at a solution indirectly. It is a well-known fact that much of the butter and milk consumed in large cities contains a con-

* For complete summaries see Salmon, Relation of Bovine Tuberculosis to the Public Health, Bureau of Animal Industry No. 33, 1901, and Kober, The Transmission of Bovine Tuberculosis by Milk, with a Tabulation of Eighty-six Cases, Trans. Assoc. Amer. Phys., vol. xviii, 1903.

siderable number of living tubercle bacilli (Perlsucht bacilli). If these are pathogenic to human beings, we ought to find among the inhabitants of large cities, who daily swallow these living, virulent organisms, and thus unconsciously carry out the very experiment which we could not undertake, many cases of tuberculosis that can be traced to food contaminated with the tubercle bacillus; especially ought this to be true in children. . . . In reality it is not so. We can admit infection with tuberculosis through food containing tubercle bacilli only when the intestine is the seat of the first lesion, *i. e.*, in cases of primary intestinal tuberculosis. Primary intestinal tuberculosis, however, is extremely rare. . . . And in the few cases reported it has not been conclusively proved that we are dealing with an infection with bovine tuberculosis. . . . The chances are equally in favor of its being of the human form. . . . To-day we are able to make a diagnosis. It is necessary merely to isolate the organism from the tuberculous material in pure culture, and by inoculation into cattle establish whether it is of the human or the bovine variety. . . . For half a year I have experimented along these lines, but, owing to the scarcity of material, have been able to examine only a few cases. So far results do not indicate the occurrence of bovine tuberculosis in man. . . . Although the question whether man is susceptible to bovine tuberculosis has not been definitely answered, and probably cannot be immediately answered, we may safely say that if such susceptibility does exist, the infection takes place rarely. I should be inclined to consider the number of cases of tuberculosis caused by milk, butter, or meat of tuberculous cattle not much greater than that of hereditary cases, and I believe, therefore, that no special protective measures are indicated." These views found violent opposition in most quarters. Numerous investigations followed as to the identity or non-identity of the bacillus from man and cattle. At the same time the viruses from man were investigated, as to whether they were identical with those from cattle or not. The resulting evidence left no doubt of the infectiousness of the bovine virus for children, but in the case of adults this was not established.

The importance of the question from the human standpoint rests on the percentage of such infection. The control of tuberculosis in cattle is probably necessary anyway from a purely commercial standpoint. If, however, bovine tuberculosis is a menace, that is, causes an appreciable percentage of the tuberculosis in man, the control involves the production of milk and its products free of any possible infectious material. With a milk-supply such as that of New York and other cities, which of average quality yields tubercle bacilli in 6 to 16 per cent. of the samples examined, the changes necessary

to render this supply innocuous are far reaching. The real solution of such a sanitary problem must rest on the incidence of bovine infection in man deduced from the examination of a large series of non-selected cases of different types of disease. Further, these cases must be considered from the standpoint of disablement or death caused by bovine infection.

The numerous investigations, especially those of the English and German Commission, have settled many of the disputed points. Nearly all the cases examined, however, have been selected because they were thought likely to be due to bovine infections, that is, tuberculosis of alimentary origin has been the main type of cases examined. It seemed to us, with the knowledge at hand, that a large series of non-selected cases of every type of disease obtainable, and further cases under average conditions of exposure to infection, would add to our knowledge of the true extent of bovine infection and so give information of great importance in sanitary control. Further, any additional technical points, especially tending to the very simplest methods of differentiation, would be of value. In the examination of such a large series of cultures we hoped that many disputed or doubtful points in biology and virulence could be settled.

Isolation and Cultivation.—All cultures were isolated by means of the guinea-pig. Egg-media have been so successful that they have been almost exclusively used, the following two combinations being employed: Egg-medium, after Dorset, the whole egg mixed with 10 per cent. of water; after Lubenau, ten eggs mixed with 200 c.c. of glycerin bouillon. The tubed medium was coagulated at 70° C. for two hours in an inspissator we have devised, and then incubated for sterility. If necessary, additional fluid may be added to supply the necessary moisture.

Both types of media were used for isolation, as we found that glycerin often inhibited the growth of the bovine virus. The following table shows the comparative growth of bovine viruses in the primary cultures after three weeks' incubation:

PRIMARY CULTURES—BOVINE TYPE

Source of Cultures	Growth Negative or Much Poorer on Glycerin Egg	Growth Equal or Nearly so on Glycerin Egg	Growth Better on Glycerin Egg
Man.....	23 or 79 per cent.+	5 or 17 per cent.+	1 or 3 per cent.+
Cattle (3 milk).....	23 or 85 per cent.+	3 or 11 per cent.+	1 or 3 per cent.+
Both combined.....	46 or 82 per cent.+	8 or 14 per cent.+	2 or 3 per cent.+

In contrast to the above, the human virus invariably grew better from the

start on glycerin egg, and in the great majority of cases this increased luxuriance was very noticeable.

Although the two types show differences in the amount of growth on plain egg, the above influence of glycerin still further accentuates this difference. For this reason we have used glycerin egg as a basic differential medium, and from the amount of growth on this medium alone we have been able, in practically every instance, to tell the type of organism. For this reason the following general conclusions are justified. It is assumed that all conditions are suitable for growth.

(*a*) All cultures growing luxuriantly on glycerin egg from the start are of the human type.

(*b*) All cultures growing sparsely or even not at all on glycerin egg in the first few generations are of the bovine type.

The amount of growth in the early generations is the only specific difference we have noticed. Although the human type tends to produce a dry, pigmented growth, and the bovine type a more moist, non-pigmented growth on this medium, these differences are not absolutely specific. Pigment production also occurs in bovine viruses on further cultivation.

To control the above differences we used a medium free of coagulable albumins, as further index of the saprophytism of the two groups. Glycerin potato was found the most uniform medium for this purpose.

On the basis of the results on these two media we have subdivided our cultures into groups. The amount of growth was estimated by inspection. The best-growing tube was selected for observation for the reason that this showed the maximum capacity of growth of this virus, the other tubes being poorer because of technical differences not under our control. Nine grades of growth were arbitrarily selected. Grades 1 to 3, sparse; grades 4 to 6, moderate; and grades 7 to 9, luxuriant. Grade 9, however, was seldom used, being reserved for exceptionally luxuriant transfers.

It is to be noted that where the first three generations are spoken of it refers to the total number of generations, regardless of the media. In some instances, especially in the bovine cultures, plain egg was used at the start. Where, however, five generations on glycerin egg are mentioned, this means five successive transfers on this medium.

Human Type.—Group 1: Glycerin egg, grade 7 to 8 in the first three generations, and showing pigmentation in the early generations. Glycerin potato. Grade 6 to 8 in the first four generations.

Group 2: Glycerin egg, same as Group 1. Glycerin potato—(*a*) less than grade 6 or (*b*) negative or slight in the first four generations.

Group 3: Glycerin egg. Grade 4–6 in the first three generations, pigment slight or absent in the early generations. Glycerin potato, grade 3–5 in the first four generations.

Group 4: Glycerin egg, as in Group 3. Glycerin potato, negative or practically so in the first four generations.

Group 3 and 4 may or may not show increase of growth in the first five generations on glycerin egg or other glycerin media.

Bovine Type.—Group 1: Glycerin egg. Grade 0–3 in the first three generations, and growth remaining sparse, or at most increasing slowly in the first five generations on glycerin egg. Glycerin potato slight or negative in the first four generations.

Group 2: Glycerin egg. Grade 4 in the first three generations. That is, growth is better than group 1, but not increasing any more rapidly in the first five generations on glycerin egg. Glycerin potato, slight or very moderate in the first four generations.

Group 3: At first as in group 1 on both glycerin egg and potato, but increasing rapidly in amount in the first five generations on glycerin egg, so that the amount of growth on this medium reaches grade 7. Pigmentation begins to appear on reaching the higher grades. It is then equal to the human type in amount of growth.

Classifying our cultures according to their source and the group into which they fall gives us the following tables:

HUMAN TYPE—FROM MAN

Group	I	II	III	IV
Number	387	13	2	2
Per cent	95	3	0.5	0.5

BOVINE TYPE—FROM MAN

Group	I	II	III
Number	33	0	0
Per cent	100	0	0

BOVINE TYPE—FROM CATTLE (FIVE FROM MILK)

Group	I	II	III
Number	26	1	2
Per cent	89	3	6

BOVINE TYPE (COMBINATION OF TWO PRECEDING TABLES)

Group	I	II	III
Number	59	1	2
Per cent	95	1	3

When we examine these tables we find that the human type, groups 1 and 2, contains the large total of 98 per cent.+ of the human viruses, and the bovine type, group 1, contains 95 per cent. of the bovine viruses. In other words, 98 per cent. of all viruses fall into groups that are so distinctive as to be surely diagnostic.

Human type group 3 and bovine type group 3, considering the early generations alone, are distinctive enough for diagnosis of type. This really leaves only two groups where any trouble was encountered, and in these groups fell only 3, or 0.6 per cent.+, of the total viruses.

We also tried to verify the findings of the "Gesundheitsamte" as to the differences of growth on glycerin bouillon, and in so far as our cultures were of early generations, the results were the same. Compared with the above simpler methods of differentiation we found bouillon cumbersome and often difficult and uncertain to handle. Indirectly, we noted a phenomenon which, however, accords with their findings. We had been in the habit of adding glycerin bouillon to the glycerin-egg tubes, so that a pellicle would grow from the egg on to the bouillon. Every virus of the human type, even those which grew most poorly, quickly formed a medium or thick pellicle, whereas the viruses of the bovine type failed to form a pellicle in the first few generations. This was so even though we have noticed pellicle formation in potato tubes with bovine viruses in the second generation, the pellicle, however, being exceedingly delicate. We have attributed this failure of bovine viruses to form a pellicle in egg tubes to the marked tendency to moistness of growth on this media. Whatever the reason, this observation has helped to differ-

entiate the groups which in the above classification approached each other in amount of growth.

Although we find that the two types differ markedly culturally, and, therefore, agree with the findings of Smith, the "Gesundheitsamte," and others, still we find that intermediate types of growth also occur, as pointed out by Rabinowitch, Fibiger and Jensen, the Royal Commission, and others. We disagree, however, with these latter observers in the frequency with which these intermediate types of growth occur, and find that they are no argument against the existence of two types, as even in these cases, with the added factor of pellicle formation, we were able to make a tentative diagnosis of type which was borne out by the virulence tests.

Morphology.—Cultures on plain and glycerin egg, glycerin agar, glycerin potato, and glycerin broth have been examined at various generations, and the only appreciable differences noted were on glycerin egg, and this only after cultivation for some generations. The human type tends to be longer and unevenly stained; the bovine type to be short and evenly stained. Although one could in many instances make a probable diagnosis of type from an inspection of the smear, the number of intermediate gradations in morphological differences rob it of nearly all its practical value.

Rabbit Virulence.—Every virus was inoculated into rabbits to test its virulence. The intravenous method of inoculation in doses of 1 or 0.01 milligram or both has been used. The criterion used in making observations has been macroscopical lesions only, assuming the size and number of these lesions to be an index of the progressiveness of the disease.

Broadly stated, our conclusions are: The bovine type of tubercle bacillus in every instance causes a generalized tuberculosis in doses of 0.01 milligram intravenously, the tuberculosis being progressive and causing the death of the animal. Human viruses injected in the same amount produce no disease at all, or lesions of varying severity in the lungs or kidneys or both, and never causing a generalized tuberculosis. Even with 1 milligram, that is, 100 times as much, the lesions are usually confined to the same organs, and though there is very slight tendency to generalization with this dose, there is never a generalization showing a progressive nature. Rabbits injected even with the larger dose live indefinitely, and, if death should occur, the tuberculous lesions are usually not extensive enough to say that the animal died of the disease.

The 1 milligram dose is not favorable for differentiation. As stated above, it occasionally produces some generalization in rabbits inoculated with the human virus, whereas with the bovine virus the animal dies so acutely that

evident generalization is often not marked. Even with a somewhat longer period of life the generalization is not so evident as in the less acute disease following the inoculation of 0.01 milligram. If, however, a rabbit survives the inoculation of 1 milligram, one is sure that the virus is of the human type.

Our experience has shown that it is necessary to inoculate from early generations to avoid error due to loss of virulence in occasional cultures.

Using the 0.01 milligram dose, one must remember that this invariably causes generalized tuberculosis with bovine viruses, whereas with a human virus, although a chance localization may occur elsewhere than in the lungs and kidneys, this is exceedingly rare, and occurs only in one or two rabbits in a series. For this reason it is to be attributed to accidental variation in the rabbit, not to the culture.

We have not observed any tendency of the two types to approach each other in virulence to any extent, which would in any way impair the value of rabbits for differentiation. Large doses are to be avoided, and many so-called "atypical" results are founded on such dosage. It may even be possible that the subcutaneous method might, in the few instances where marked lesions are reported with use of 10 milligrams, have shown more distinctive differences with smaller doses. In fact, we believe that the tendency should be toward the use of the smallest dose, which, with a bovine virus, invariably causes generalized tuberculosis. In this way we shall accentuate the virulence of this type so much that variations in the human type toward greater virulence will rarely, if ever, lead to any difficulty.

Calf Virulence.—It was out of the question for us to test every virus in calves. Our cultural and rabbit work correlated each other so closely as to make it unnecessary. We have used the subcutaneous method with a dose of 50 milligrams in each case.

Eighteen strains of the human type were inoculated, and 14 of the bovine type, of which 8 were from man. The inoculation of the human type of bacillus caused only a local tuberculosis, with extension at times to the neighboring lymph-nodes. In one instance some doubtful lesions in the lungs were positive in guinea-pigs. In another case some abdominal nodes, typical macroscopically, failed to infect guinea-pigs. The bovine type, however, usually caused a markedly progressive disease, with the exception of two strains, which rabbit controls showed had lost their virulence. In two instances only did the animal survive a period of one hundred and twenty days, and then showed generalized tuberculosis, but of a regressive type.

These observations closely parallel the results in rabbits—the bovine virus causing a generalized tuberculosis, usually fatal, the human virus causing

usually a strictly localized tuberculosis, and only occasionally causing slight dissemination.

On the whole, we believe that the necessity of using calves for routine differentiation is past. Although it is possible that occasionally this added evidence may be of value, this, however, must be very rarely, if ever, the case, according to our own observations.

Viruses Showing Variant Characters (Atypical Viruses).—Slight variations from the extreme types were present culturally and in virulence. No one would think of these as atypical viruses. Narrowing down to those viruses which showed the closest relationship, we have the few cases where a bovine virus grew somewhat better than usual or increased very rapidly in amount of growth, or where a human virus grew more sparsely than the type, or increased slowly from poor original tubes.

In these cases we have a distinct tendency to bridge the gap between the two types, considering the cultural characteristics alone. But even in these cases differentiation was possible and predictions as to virulence were fulfilled.

The variations in virulence that we have noted are slight, and in the majority of instances seemed to depend rather on the individual rabbit than on the culture.

Many of the cases reported in the literature seemed to us to have been incompletely controlled. Nor is one always certain that cultural and virulence observations were made in early generations. In some instances the possibility of a mixed infection is not excluded.

That variations from the extreme types in individual characteristics occur we admit. This, however, is to be expected. Bacterial classification is not stereotyped in any group of organisms. Considering the sum of the different characteristics, the great majority of viruses, however, clearly group themselves around two extreme points, and there is no tendency of a complete and gradual gradation of one type into the other. This fact constitutes the clearest possible evidence of the existence of two types, and the reliability of the methods of differentiation.

Correlation of Cultural Characteristics and Virulence.—All viruses from man and cattle fall into two types. According to type, cultural luxuriance is inversely proportional to animal virulence. Variations may occur in individual viruses in one characteristic, but without parallel variation in the other. The deductions which have been made as to correlation of the amount of growth and virulence in individual viruses of one or the other type are, therefore, fallacious.

Necessary Data for Differentiation of Type.—Culturally, one can differentiate practically all viruses with surety. In case of doubt or lack of sufficient experience in the handling of cultures the intravenous inoculation of 0.01 milligram will settle the question. Observations of cultures and virulence must be done in the early generations. As has been stated, calf inoculations are unnecessary, except possibly in very exceptional instances.

Passage Experiments.—Nine strains were reisolated from calves injected with these strains to test their virulence. The cultures were tested with varying completeness, but in no case was there any suggestion of change in any characteristic. The period of residence in the calf was one hundred and forty to one hundred and forty-two days. These results constitute further evidence that no rapid change takes place.

We have carefully analyzed the reports of numerous workers on this point, and cannot admit that the evidence for the transformation of type is complete. Change of virulence is a possibility, but this is not the only change recorded—the other characteristics were also changed.

The possibility of spontaneous tuberculosis is very difficult to exclude, and too often cattle inoculated with the bovine type from man are forgotten as a possible source of infection. In some cases the animals have not been tested with tuberculin, or too long a time elapsed before they were used. In other instances the knowledge of the virus inoculated is incomplete; there is even the possibility, in some cases, of a mixed infection. Furthermore, isolations from the animals used have not always been made from different organs and tested. The lack of sufficient controls culturally and by tests of virulence in rabbits weakens the evidence very markedly. The use of rabbits ought to help one in cases where contradictory results are found, due apparently to mixed infections.

Apart from the experimental work, which is inconclusive, the persistence of bovine characters in bacilli infecting man is very strong. Apart from the butcher's tubercles, where there is no change even after eight years, we have the cases of natural infection. The clinical details give us a reasonable certainty that the lesions have been present over a period of a year or two or longer. In one case Oehlecker considers the duration to have been at least six and three-fourth years. These facts, contrasted with the results of passage experiments, where the ever-present error of spontaneous infection can never be absolutely excluded, should make us careful in drawing any deductions from the experimental data at hand.

Smith Reaction.—Our work has not progressed much beyond the initial stage, only 44 strains having been tested.

The bovine viruses have given a typical reaction curve, although four have at one time gone to or beyond the neutral point. Two viruses, both isolated from man and of the human type, gave a typical bovine curve. Both were alike in forming a thin pellicle.

Thirty-two viruses have been grown on glycerin litmus milk, as advised by the Royal Commission. No initial alkaline stage was observed in four. All the human type later became acid, but 14 had not coagulated the milk at the end of ninety-four days. The remainder caused clotting in from forty-seven to one hundred and twenty-two days. One bovine virus has remained alkaline, and the same is true of one of the human viruses giving an alkaline reaction in bouillon, the other not having been tested.

The results thus far obtained agree essentially with those of Smith. How far intermediate reactions occur, such as reported by the Royal Commission, we cannot say. Lewis found the same exceptions as we have. Whether our observations will be the same when these viruses are further controlled remains to be seen. Such exceptions, if constant, would materially impeach the specificity of the reaction.

Conclusions.—Tubercle bacilli, as isolated from man, fall into two groups. One of these groups is identical in all its characters with those found in cattle. That is, all tubercle bacilli from man and cattle fall into two groups, which have been designated the human and bovine types.

Each type shows certain differences, the most important for separation being those found culturally and in virulence. The great majority of cultures group themselves around two extremes, from which there are a few cultures showing variant characteristics. There is no overlapping of characteristics.

These two types are probably different, due to the residence in different hosts over long periods of time, and as such are stable. The evidence in favor of rapid change of type is incomplete and inconclusive.

Tabular Summaries of Cases Examined.—It is evident, on reading the tabulation of cases as given by individual authors, or those attempting to summarize the results up to date, that a tabulation founded on some uniform method would be of value. We have, therefore, analyzed each individual case and attempted to formulate a set of diagnoses covering clinical or anatomical details. The following headings were finally decided upon, and although open to criticism, it has the advantage that even if defective, the tabulations are comparable.

As it stands, there is difficulty at times in deciding where a case should be placed; the majority of cases, however, fall easily in one group or the other. Certain divisions are not mutually exclusive, because in one instance an

anatomical diagnosis is used, in another the clinical diagnosis, which, with autopsy, could have fallen under a different heading. It seemed, however, advisable to attempt to show the extent of the process where possible.

CLASSIFICATION OF CASES USED IN TABULAR SUMMARIES

1. *Pulmonary Tuberculosis.*—Where the lesions are confined to the thoracic organs, clinical or postmortem diagnosis. A few lesions elsewhere disregarded, especially where abdominal lesions were present which might be regarded as infection by ingestion rather than true generalization.

2. *Tuberculous Adenitis.*—Other than cervical or internal nodes.

3. *Tuberculous Adenitis, Cervical.*—Where the nodes are apparently only infected, or this lesion is overwhelmingly predominant. Where this lesion was primary, as far as could be ascertained. If abdominal lesion also, is classified under that heading. If part of a generalized tuberculosis, classified under that heading.

4. *Abdominal Tuberculosis.*—Tuberculosis of intestines, abdominal lymph-nodes, or peritoneum, with or without tubercles in the spleen or liver. There may be coincident lesions in the cervical nodes. If there was spreading to thoracic organism, see Generalized Tuberculosis.

5. *Generalized Tuberculosis.*—Alimentary origin.

6. *Same, with involvement of meninges.* (Cases with cultures from the meninges are noted.)

7. *Generalized Tuberculosis.*—Respiratory or unknown origin.

8. *Same, with involvement of meninges.*

9. *Tubercular Meningitis.*—Clinical diagnosis, extent of generalization unknown or associated with localized lesions elsewhere.

10. *Tuberculosis of Bones and Joints.*—Where these lesions are the essential part of the disease.

11. *Tuberculosis of Genito-urinary Organs.*

12. *Tuberculosis of Skin.*

13. *Miscellaneous Cases.*

Subdivisions 3, 4, 5, and 6 will then contain all cases of alimentary infection as far as can be determined from the statements of the different investigators. This classification will refer mainly to the distribution of the lesions. In the children it seemed advisable to give some idea also of the severity of the disease. In the cases, therefore, of abdominal and generalized tuberculosis, exclusive of the meningeal cases, which are fatal, we have subdivided the cases in the children according to the severity of the disease. This has been done by splitting the space for these cases by a vertical ruling, and placing the serious or fatal cases to the left of the line. This has not been done with adult cases, so that slight or latent lesions, which at times were disseminated, are included. These are few in number, and it seemed that to further com-

plicate the tables by separating these cases would give no commensurate gain. Where a bovine infection, however, is noted in an adult, the extent and severity of the lesion will be given.

Absolute completeness is not affirmed for the following tables, but is complete in that it covers all the important series of cases. It would have been possible, in reviewing the literature covering inoculation experiments, to pick out cases for tabulation or summary, but in most instances the details would be found insufficient and the result not worth the labor involved. Other reports have been found, but were unavailable.

The tables include only cases where pure cultures were isolated. In the text are given cases which either were part of a series or seemed important enough for mention.

The final tabulation is a composite of the tables only. For economy of space the different authors are given in one table. Where the work is from one laboratory or group of workers, the figures are not given separately according to the author.

The name of each author in the composite tables is given a small letter, and his cases given in the table on the line marked by this letter.

TABULATION OF CASES REPORTED BY:

a. Smith, Smith and Brown, and Lewis.
b. Ravenel.*
c. De Schweinitz, Dorset and Schrooder, and Mohler and Washburn.*
d. Kossel, Weber and Heuss, Weber and Taute, Oehlecker, and Dieterlen.
e. Weber.
f. Hoelzinger.
g. De Jong-Stuurmann.
h. Dammann and Mussemaier.*
i. Hennchen, Jundell and Svenson.
j. Rabinowitch* and Beitzke.*
k. Royal Commission.
l. Watt.
m. Kitasato.
n. Hess.
o. Gorter.
p. Fibiger and Jensen.*
q. Burckhardt.*

* Where figures, names, or letters are starred, see notes under author's name following this tabulation.

Diagnosis of Cases Examined	Authors	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years	
		Human	Bovine	Human	Bovine	Human	Bovine
Pulmonary tuberculosis	a	9*	..	1	..	..	..
	b	2#	..	..	..	..	..
	c	13*	..	..	..	..	..
	d*	62	..	1	..	5	..
	g	..	1?*	..	..	..	..
	h	2	..	..	..	..	..
	i	1	..	1	..	..	..
	j	8	..	..	..	2	..
	k	10	..	..	..	..	..
	m	152*	..	..	..	..	..
	o	21*	..	..	..	..	..
	p	10	..	..	..	..	..
Totals		290	1*	3	..	7	..
Tuberculous adenitis, axillary	d	..	..	..	..	1	..
	i	..	..	..	..	1	..
	p	1	..	..	..	..	..
Totals		1	..	..	..	2	..
Tuberculous adentitis, cervical	a*	5	1	2	7	..	3
	c	..	..	2	..	..	..
	d	2	..	4	3	6	3
	h	1	..	..	..	..	..
	i	1	..	1	..	1	..
	j	4	..	1	..	1	1
	k*	..	..	4	2	1	1
Totals		13	1	14	12	9	8
Abdominal tuberculosis	c	..	..	.. ..	1 ..	.. ..	.. ..
	d	6	..	.. 2	2 2	1 2	.. 4
	h	1	1*	.. ..	.. ..	.. ..	.. ..
	j	2	2	.. 4	.. 1	.. 1	1 ..
	k	..	..	.. ..	.. ..	.. ..	3 ..
	n	1	..	.. ..	.. ..	2 ..	.. ..
	p	..	..	.. ..	.. ..	.. ..	1 ..
	q	4	..	.. ..	.. ..	.. ..	1 ..
Totals		14	3	.. 6	3† 3†	3 3	6 4

*Where figures, names, or letters are starred, see notes under author's name following this tabulation.

† The cases in children are arranged in two columns, the grave or fatal being placed on the left. Those on the right are mainly cases which died from other causes or were accidentally found.

Diagnosis of Cases Examined	Authors	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years	
		Human	Bovine	Human	Bovine	Human	Bovine
Generalized tuberculosis, alimentary origin	a	2	..	.. ..	.. ..	1 ..	1 ..
	b	..	..	.. ..	.. ..	1 ..	.. ..
	c	..	..	.. ..	1 ..	.. ..	1 ..
	d	3	..	1 ..	2 ..	.. ..	.. ..
	f	..	1*	.. ..	.. ..	.. ..	.. ..
	h	..	..	.. ..	.. ..	2 ..	.. ..
	j	1	..	.. ..	.. ..	2 ..	1 ..
	k	..	..	1 ..	.. ..	6 ..	4 ..
	p	..	..	.. ..	.. ..	.. ..	2 ..
Totals		6	1	2 ..	3 ..	12 ..	9 ..
Generalized tuberculosis, including meninges, alimentary origin	a	..	..	..	..	1	1
	b	..	..	..	..	..	1
	d	..	..	1	..	..	3
	j	..	..	..	..	1	..
	k	..	..	..	..	1	3
Totals		..	..	1	..	3	8
Generalized tuberculosis	a	1	..	.. ..	.. ..	.. ..	.. ..
	c	1	..	1 ..	.. ..	.. ..	.. ..
	d	15	..	.. ..	1 ..	2 ..	.. ..
	h	3	..	1 ..	.. ..	1 ..	.. ..
	i	1	..	.. ..	.. ..	.. ..	.. ..
	j*	4	..	1 ..	.. ..	8 2	1 ..
	k	1	..	.. ..	.. ..	1 ..	.. ..
	p	..	..	.. ..	.. ..	2 ..	.. ..
Totals		26	..	3 ..	1 ..	14 2	1 ..
Generalized tuberculosis, including meninges	b	..	..	..	..	1	..
	c	1	..	..	..	1	..
	d	..	..	1	..	9	..
	h	1	..	..	..	..	..
	i	..	..	1	..	..	..
	j	2	..	3	..	14	..
	k	..	..	2	..	1	..
	p	..	..	..	..	1	..
Totals		4	..	7	..	27	..
Tubercular meningitis	c	..	..	1	..	..	..
	l	..	..	..	..	..	1*
Totals		..	..	1	..	..	1

*Where figures, names, or letters are starred, see notes under author's name following this tabulation.

Diagnosis of Cases Examined	Authors	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years	
		Human	Bovine	Human	Bovine	Human	Bovine
Tuberculosis of bones and joints	d*	12	..	11	1	13	..
	i	1	..	1	..	1	..
	k	4	..	4	..	1	..
	q	..	1*	..	..	..	..
Totals		17	1	16	1	15	..
Genito-urinary tuberculosis	a	1	..	..	..	..	..
	c	1	..	..	..	..	..
	d	2	..	..	..	..	..
	i	2	..	..	..	..	..
	k	2	..	..	..	..	..
Totals		8	..	..	..	..	..
Tuberculosis of skin	d	1	..	1	..	..	..
	i	..	..	..	..	1	..
Totals		1	..	1	..	1	..
Miscellaneous cases:							
1. Tuberculosis of tonsils	n	..	..	..	1	..	..
2. Primary tuberculosis of mouth. Cervical adenitis	e	..	1*	..	..	..	..
3. Tuberculous sinus	c	1	..	..	..	..	..
4. Sepsis. Latent bacilli	p	..	..	..	..	1	..

MIXED OR DOUBLE INFECTIONS. BOTH TYPES (d)

Generalized tuberculosis, alimentary origin.	30 years—Mesenteric node—B. and H. type. Bronchial node—H. type.
	5½ years—Spleen—H. type. Mesenteric node—B. type.
Generalized tuberculosis, including meninges, alimentary origin.	4 years—Meninges—H. type. Bronchial node—H. type. Mesenteric nodes—B. type.

*Where figures, names, or letters are starred, see notes under author's name following this tabulation.

NOTES TO PRECEDING TABULATION

a. Smith: Sputum 1 not included; from the characteristics of this culture as described it is doubtful whether this was a true tubercle bacillus.

a. Lewis: Dr. Lewis supplied us with the ages of his individual cases of cervical adenitis. One case, age not given, B. type not included.

b. Ravenel: Other cultures than those given spoken of by author, but no details of cases given, and, therefore, not available for tabulation.

c. Mohler and Washburn: Sputum c not included. This culture showed a higher virulence than usual; results too irregular to make any decision. Besides the cases given, they examined cultures from the mesenteric lymph-nodes of five children affected with infantile tuberculosis, one of which was the bovine type. No age or details of cases given. The advisability of tabulating the cases of these authors seemed doubtful. All the cultures were not fully tested, only representatives of different groups. Great irregularities were present, and although they look upon these as evidence of variability, it is more probable that the greater part was due to their methods. The bovine types stand out prominently, and comparison with these gives practical certainty that the other cultures were of the human type.

d. Kossel, Weber and Heuss, Weber and Taute: Two of their cases not tabulated. One case of pulmonary tuberculosis, no age stated, gave the human type of bacillus. One case of tuberculosis of bones and joints, child, age not given, was a human infection.

e. Weber: The case given was a woman twenty-nine years old, drank raw milk from a badly tuberculous cow over a period of two years. The condition in the mouth was progressive, and the cervical nodes were involved. Râles developed in the lungs and the patient died. No autopsy. Cultures from cervical nodes.

f. Hoelzinger: Case given was twenty-four years old. Abdominal pain since childhood. The disease was progressive and fatal; cultures from lung and mesenteric node. Unfortunately, the material first passed through rabbits. Although probably bovine only, a possible mixed infection might be eliminated in this way.

g. De Jong-Stuurman: Milkmaid twenty-seven years old. Had frequent diarrhea. Undoubtedly the authors had a bovine virus. Whether there was some admixture of the human type one cannot determine from the data given. As the isolation was not repeated, collecting the sputum with all necessary precautions against contamination and at frequent intervals, one cannot say that the lesions were due to the bacillus isolated. One of their calves presumably was spontaneously infected from a calf inoculated with this virus.

h. Dammann and Mussemaier: The case of abdominal tuberculosis giving the bovine type of bacillus was twenty-five years of age. Operation was followed by recovery. No ascites five months later. The results of their examinations culturally and in rabbits are practically typical. The inoculation results in calves and swine contradict each other, and are not parallel with

those in rabbits. (For a complete criticism of their work see Kossel, Cent. f. Bakt., Orig., Bd. xlii, pp. 401 and 489.)

j. Rabinowitch: We have placed the atypical cultures reported in her earlier article in the human group. She says: "The six atypical strains which show deviation from the human type cannot be characterized as bovine strains." The atypical cultures reported in the paper on latent tuberculosis are not included; no details were given on which to base an opinion, and the five so classified had to be omitted. An additional case, generalized tuberculosis, twenty years, given as an infection with the avian type. Cultures from the spleen.

j. Beitzke: What was said above concerning "atypical" strains holds true here.

k. Royal Commission: One case, no age given, of cervical adenitis gave the human type of bacillus.

l. Watt: History of case interesting. Farm servant had three children, aged nine, six, and five years. Moved to present farm May, 1906. Oldest child died January, 1907, with symptoms of tubercular meningitis. The youngest child died March 18, 1907, with similar symptoms. Autopsy revealed tubercular meningitis and a caseous mesenteric node. The milk given these children was from a tuberculous cow with udder disease. The milk yielded tubercle bacilli on subsequent examination, which were isolated in culture. Cultures were isolated from the cerebrospinal fluid of the youngest child and were of the bovine type. (For reports of similar investigations on infection following ingestion of tuberculous milk see Zwick and Weber, p. xxx).

m. Kitasato: Cases reported were from fifteen to sixty-three years. Because of the absence of individual ages and slight discrepancy, the limit for children being given as sixteen years, we have included these cases among the adults.

o. Gorter: In a few protocols age not given. Descriptions give a reasonable certainty that they were all adults.

p. Fibiger and Jensen: They give no tabular summary of their results according to type, so that the division into types is wholly our interpretation of their findings. They had strains showing variations, which are included in our tabulation, though we were doubtful about including Case 5. Although the authors admit that high virulence points to bovine origin, they do not admit the reverse, and make no division into types.

q. Burckhardt: The cases given are from a preliminary report. Six cases only had sufficient information to be admitted. Twenty-eight other cases are mentioned; the final report is to cover 49 cases of surgical tuberculosis. The bovine joint infection was of the knee, and ran a favorable course.

TOTAL SUMMARY OF TABULATED CASES

Diagnosis of Cases Examined	Adults Sixteen Years and Over		Children Five Years to Sixteen Years		Children Under Five Years	
	Human	Bovine	Human	Bovine	Human	Bovine
Pulmonary tuberculosis	290	1(?)	3	..	7	..
Tuberculous adenitis, axillary	1	..	..	..	2	..
Tuberculous adenitis, cervical	13	1	14	12	9	8
Abdominal tuberculosis	14	3	.. 6	3 3	3 3	6 4
Generalized tuberculosis, alimentary origin	6	1	2 ..	3 ..	12 ..	9 ..
Generalized tuberculosis	26	..	3 ..	1 ..	14 2	1 ..
Generalized tuberculosis, including meninges, alimentary origin	..	..	1	..	3	8
Generalized tuberculosis, including meninges	4	..	7	..	27	..
Tubercular meningitis	..	..	1	..	..	1
Tuberculosis of bones and joints	17	1	16	1	15	..
Genito-urinary tuberculosis	8	..	..	..	..	..
Tuberculosis of skin	1	..	1	..	1	..
Miscellaneous cases:						
Tuberculosis of tonsils	..	..	..	1	..	..
Tuberculosis of mouth and cervical nodes	..	1	..	..	..	..
Tuberculous sinus	1	..	..	..	..	..
Sepsis, latent bacilli	..	..	..	..	1	..
Totals	381	8	54	24	99	37

Mixed or Double Infections, 3 Cases:

Generalized tuberculosis, alimentary origin, thirty years, human and bovine type in mesenteric node; human type in bronchial node.

Generalized tuberculosis, alimentary origin, five and one-half years; human type in spleen; bovine type in mesenteric node.

Generalized tuberculosis, including meninges, alimentary origin, four years, human type in meninges and bronchial nodes; bovine type in mesenteric nodes.

Total cases, 606.

The following investigations are appended because of their bearing on certain points at issue.

Zwick*: Two supposed cases of milk infection. Both children drank plentifully of milk from a cow with udder tuberculosis. On finding the cow thus badly infected, the tuberculosis in the children was naturally referred to this source, and on their death cultures were isolated and tested, with the following results. Seven other children are healthy.

Generalized tuberculosis, including meninges, human type: K. L., four years. Pott's disease for one year; ill for about two months. Cultures from meninges, lung, and vertebral abscess.

* Cultures from these cases and from the cow also reported by Weber and Taute, and details also given by Weber.

Genito-urinary tuberculosis, human type: Kath. L., sixteen years. Primary tuberculosis of uterus and tubes; tuberculous peritonitis; localized tuberculous nodules in lungs; perforation of small intestine. Cultures from mesocolon, omentum, mesenteric node, lungs, and uterus.

These two cases clearly show the absolute necessity of a bacteriological diagnosis of type, and of how little value are other methods as investigation of type of infection and probable source of infection.

Weber reports that in the period from early in 1905 until April, 1909, 113 instances of udder tuberculosis were reported to the Gesundheitsamte. About 628 persons partook of the milk, mostly over long periods.

In 44 instances it was stated that the milk was boiled or used mixed with that of many cows. In spite of this, and with the close contact with cattle as tuberculous as these, there must have been some transference of the infectious agent.

The remaining 69 instances are mainly considered. Milk from these cattle was taken raw or as milk products by 360 persons, 151 being children.

In only two instances (ages one and five-sixth years and one and one-fourth years) could definite infections from the milk be determined. They were both cases of cervical adenitis, and the bovine type of bacillus was isolated. Both alive and well two and one-half and one and one-half years later. The other children in the same families, eight in all, ranging in age from three to twelve years, show no evidence of infection.

A small number of cases were tuberculous suspects, cervical nodes were enlarged, or isolated cases gave abdominal symptoms. It was not possible to examine these cases bacteriologically. At least, none showed any progressive symptoms, but rather the reverse.

Another series of suspects were proved non-tuberculous. In three instances (one, the cases already reported by Zwick) the cultures gave the human type of bacillus. In two this was to be expected, the cases being adults.

Interesting contrasts in susceptibility are noted; thus in four instances two calves and six swine developed tuberculosis from the same milk, which was innocuous for the persons drinking it.

Gaffky inoculated the mesenteric and bronchial nodes from 300 children into guinea-pigs. The ages varied up to thirteen years. Thirty-three, or 11 per cent., of these children were tuberculous, three were probably tuberculous.

Of these 36, 27 gave positive results in pigs; in 17 both nodes positive, in 5 mesenteric and in 5 bronchial only positive.

Of the remaining 264 cases, apparently non-tuberculous, 30 cases gave positive results, 12 in both groups, 6 in mesenteric, and 12 in bronchial only.

Of the 300 children, then, 57, or 19 per cent., showed tuberculous nodes, 29 in both groups, 11 in mesenteric only, 17 in bronchial only.

Of the positive cases, 53 were infections with the human type. In 2 the examination was not complete. In the two remaining cases cultures had not as yet been successful. These were two bronchial nodes, the mesenteric nodes being negative. The cases are in all probability infections of the bovine type.

Tabulation of Own Cases.—As has been stated, these cases were unselected, that is, all material sent from the different institutions was examined.

Besides the tabulation of cases according to type of infection, we give two tables which give the type of infection in the fatal cases examined. The series from the Babies Hospital is given separately, because they represent average conditions better than the total cases.

The cases from the Foundling Hospital are tabulated because these cases form an unusual series. Although complete details were not obtainable, these cases constitute a set of practically exclusively cow's-milk-fed children.

TABULATION OF CASES EXAMINED

Diagnosis of Cases Examined	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years		Notes
	Human	Bovine	Human	Bovine	Human	Bovine	
Pulmonary tuberculosis	278	..	8	..	5	..	Clinical diagnosis only known, and therefore no positive details as to extent of tuberculosis elsewhere than in lungs.
Tuberculous adenitis, inguinal and axillary	1	..	4	..	..	..	See next.
Tuberculous adenitis, cervical	9	..	19	8	6	12	In two cases cultures were from axillary node, but primary focus was cervical. Another case died shortly afterward with pulmonary tuberculosis.
Abdominal tuberculosis	1	..	1	1	..	3	Milk-supply of one child subsequently examined. Tubercle bacilli isolated.
Generalized tuberculosis, alimentary origin	..	..	..	..	1	1	Only two cases are given under this heading. Many of the cases in the following subdivisions showed marked intestinal lesions and some possibly were of alimentary origin.

TABULATION OF CASES EXAMINED—(*Continued*)

Diagnosis of Cases Examined	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years		Notes
	Human	Bovine	Human	Bovine	Human	Bovine	
Generalized tuberculosis	2	..	1	..	12	4	One bovine case had tuberculous osteomyelitis of metatarsal bone.
Generalized tuberculosis, including meninges	..	..	..	..	18	1	
Tubercular meningitis	..	..	1	..	14	1	No autopsy. Extent of lesions elsewhere unknown.
Tuberculosis of bones and joints	1	..	10	..	6	..	
Genito-urinary tuberculosis	3	1	1	..	..	..	The adult bovine case was tuberculosis of one kidney. Removal of kidney. Complete recovery.
Tuberculous abscesses	1	..	..	..	..	..	Possibly primary in bone.
Totals	296	1	45	9	6 22	 2	

Double infection—both types.
Generalized tuberculosis, including meninges, thirteen months.
Mesenteric nodes gave human type.
Meningeal fluid gave bovine type.
Total cases, 436.

FATAL CASES, BABIES HOSPITAL

Diagnosis	Children Five to Sixteen Years		Children Under Five		Notes
	Human	Bovine	Human	Bovine	
Pulmonary tuberculosis	..	..	4	..	One case included probably fatal. Information incomplete.
Generalized tuberculosis	1	..	9	2	
Generalized tuberculosis, including meninges	..	..	15 See Note	1	One case gave both types of bacilli, included under bovine, as this type caused the meningitis.
Tubercular meningitis	..	..	11	1	

Total under five years, 39; 4, or 9 per cent., due to bovine type.

TOTAL FATAL CASES

Diagnosis	Children Five to Sixteen Years		Children Under Five		Notes
	Human	Bovine	Human	Bovine	
Pumonary tuberculosis	..	..	5	..	One case included, probably fatal, data incomplete.
Tuberculous adenitis	..	..	..	..	Other cases recovered as far as known.
Abdominal tuberculosis	..	..	..	3	Two other cases, one bovine and one human case, were operative with recovery, as far as known.
Generalized tuberculosis	1	..	13	3	Two other bovine cases died directly of exanthemata, with complications.
Generalized tuberculosis, including meninges	..	..	18	2	One case gave both types of bacilli, included under bovine, as this type caused the meningitis.
Tubercular meningitis	1	..	14	1	

Total under five years, 50; 9, or 15 per cent., due to bovine type.

CASES, FOUNDLING HOSPITAL

Diagnosis	Children Under Six Years *		Notes
	Human	Bovine	
Abdominal tuberculosis	..	1	
Generalized tuberculosis	3	3	Two of these cases died directly of exanthemata; the tuberculosis was not altogether negligible. These two cases not included in total fatal cases.
Generalized tuberculosis, including meningitis	1	1	
Totals	4	5	Total cases, 9.

* Six of the 9 cases were under two years, one case over five years.

COMBINED TABULATION, CASES REPORTED AND OWN SERIES OF CASES.

Diagnosis	Adults Sixteen Years and Over		Children Five to Sixteen Years		Children Under Five Years	
	Human	Bovine	Human	Bovine	Human	Bovine
Pulmonary tuberculosis	568	1(?)	11	..	12	..
Tuberculous adenitis, axillary or inguinal	2	..	4	..	2	..
Tuberculous adenitis, cervical	22	1	33	20	15	20
Abdominal tuberculosis	15	3	7	7	6	13
Generalized tuberculosis, alimentary origin	6	1	2	3	13	10
Generalized tuberculosis	28	..	4	1	28	5
Generalized tuberculosis, including meninges, alimentary origin	..	..	1	..	3	8
Generalized tuberculosis, including meninges	4	..	7	..	45	1
Tubercular meningitis	..	..	2	..	14	2
Tuberculosis of bones and joints	18	1	26	1	21	..
Genito-urinary tuberculosis	11	1	1	..	..	..
Tuberculosis of skin	1	..	1	..	1	..
Miscellaneous cases:						
Tuberculosis of tonsils	..	..	..	1	..	..
Tuberculosis of mouth and cervical nodes	..	1	..	..	..	..
Tuberculous sinus or abscesses	2	..	..	..	..	..
Sepsis, latent bacilli	..	..	..	..	1	..
Totals	677	9	99	33	161	59

Mixed or double infections, 4 cases.
Total cases, 1042.

It is evident from the data given in the cases of mixed infection that the cases reported as generalized tuberculosis including the meninges show a possible source of error unless the meningeal fluid is examined as well as the lesions from the internal organs; that is, the meningitis may be due to a different type of organism than the other lesions. This possible error would be very small, and for this reason we have given the cases in the tables whether cultures were examined or not. Any one wishing more specific information can compare the following tabulation with those already given. In the same way the information is not complete if the culture is only from the meningeal fluid. This, however, is negligible, as we are mainly interested in the cause of death, not the possibility of a less serious infection elsewhere.

GENERALIZED TUBERCULOSIS INCLUDING MENINGES

	Children Five to Fifteen Years				Children Under Five Years			
	Human		Bovine		Human		Bovine	
	Cult.	No Cult.	Cult.	No Cult.	Cult.	No Cult.	Cult.	No Cult.
Alimentary origin:								
Reported cases	..	1	..	..	1	2	2	6
Own cases	..	..	..	..	..	..	..	..
Origin respiratory or unknown:								
Reported cases	2	5	..	..	9	18	..	..
Own cases	..	..	..	..	13	5	1	..
Totals	2	6	..	..	23	25	3	6

THE AMOUNT OF TUBERCULOSIS DUE TO BOVINE INFECTION

The tables already included show the percentage of bovine infection in the different types of cases examined. The number of cases of each type of disease examined by us and other investigators to determine the kind of infection would exaggerate the importance of bovine infection if the totals of these figures only were considered. For instance, the number of pulmonary cases examined forms a much lower percentage; the cases of cervical adenitis, a much higher percentage when compared with the incidence of these types of disease against the total amount of tuberculosis. We are making a careful study of the amount of tuberculosis in New York city, and hope to present this information in a short time. At present we can only roughly indicate the total amount of bovine infection existing in the city. We have found that many cases of tuberculosis in infants are not reported correctly. When the diagnosis of cases entering the Mt. Sinai Hospital and the Babies Hospital are examined, it is found that the majority of cases of meningitis supposedly due to the meningococcus are really tuberculous in character. Fifteen per cent. of the cases of bronchopneumonia and marasmus are also found to be cases of tuberculosis. Taking these facts into consideration, we find the total percentage of bovine infection as given in the tables is too large, and estimate that such infection does not amount, in New York city, to more than 2.5 per cent. of all tuberculosis. We note that this bovine infection is largely limited to children, and the fatal cases are further limited to very young children and infants.

We have arranged the cases included in the tables so as to show the per-

centage of bovine infection according to the main types of disease and the age of the individuals infected. These are as follows:

PERCENTAGE OF BOVINE INFECTION*

Diagnosis	Adults Sixteen Years and Over	Children Five to Sixteen Years	Children Under Five Years
Pulmonary tuberculosis	**0 per cent.	0 per cent.	0 per cent.
Tuberculous adenitis, cervical	4 per cent.	37 per cent.	57 per cent.
Abdominal tuberculosis	16 per cent.	50 per cent.	68 per cent.
Generalized tuberculosis	3 per cent.	40 per cent.	26 per cent.
Tubercular meningitis (with or without generalized lesions)	0 per cent.	0 per cent.	15 per cent.
Tuberculosis of bones and joints	5 per cent.	3 per cent.	0 per cent.

* Exclusive of the cases of double infections. In considering the pulmonary cases it must be remembered, however, that bovine tubercle bacilli have been isolated from the lung in cases of generalized tuberculosis in children.

** If one doubtful case admitted, 0.2 per cent.

DISCUSSION ON DR. PARK'S PAPER

Gen. G. M. Sternberg, Washington: Those were all fatal cases, were they?

Dr. Park: No, sir; these are all kinds of cases, light, moderate, and severe. There were about 50 fatal cases outside of the pulmonary, of which latter about half died. The others were gland cases, and practically every one recovered.

Dr. W. C. White, Pittsburg: In making a transfer in recovering your cultures, I would like to ask if the culture was taken from the glands always, or if it was taken from other organs at the same time?

Dr. Park: With the guinea-pig we generally took it from the glands or from the spleen. We made no special point of where we got the culture from in the guinea-pig. From the cases themselves we always took different organs when we could, but from the guinea-pig we made no preference.

Dr. White: Usually the glandular tissue?

Dr. Park: Usually the glandular tissue, yes.

Gen. Sternberg: It seems to me probable that in the cases of meningitis the large number of cases in which the human bacilli were recovered was due to the fact that most of those cases contracted the disease directly from an infected mother. I think in tubercular meningitis, in a large number of cases, they are contracted that way direct from the mother.

Dr. Park: Yes.

THE BOVINE TYPE OF TUBERCULOSIS ASSOCIATED WITH THREE CASES OF TUBERCULOSIS IN MAN

By Marshall Fabyan, M.D.

Boston, Mass.

Practically all cases of human tuberculosis with which the bovine type of bacillus has been found associated have had their origin in the digestive tract. The invasion takes place either through the mouth or throat into the cervical lymph-nodes, or through the intestinal mucosa into the mesenteric lymph-nodes. Although the infection of cows takes place largely through the air, and first shows itself in the mediastinal or bronchial lymph-nodes, yet there is at present no evidence that adult human beings exposed to the dust of cow-stables contract tuberculosis in this way. The three cases to be briefly reported are also the result of intestinal infection.

Human No. 25.*—For the autopsy notes and material of this case I am indebted to Professor E. E. Southard, who also supplied the following data concerning the history of the patient:

Male, born in Massachusetts in 1888, of Nova Scotian parents. Became epileptic in 1893. Was admitted to Danvers Hospital in March, 1906; there showed paraplegia, epilepsy, and dementia; broke right humerus and right femur in different convulsive attacks, and died October 28, 1908, after a series of convulsions of increasing frequency, which developed into status epilepticus lasting twenty-four hours. During his stay in the hospital the patient drank raw milk daily. His mother began to show signs of pulmonary tuberculosis in 1896, but was still alive in 1906, when he was admitted.

The following facts are of interest to us in the autopsy:

Body was that of a rachitic individual, 120 cm. in length. (Barrel chest, rachitic rosary, anomalies of skull development, and distortion of the long bones.) Scars on the forehead. Pupils unequal, left larger than right.

* These numbers correspond to the serial numbers used in the Department of Comparative Pathology, Harvard Medical School, by Professor Theobald Smith.

Mesenteric lymph-nodes swollen and slightly reddened. One near the colon contained a calcified mass 1.5 cm. in diameter. Chronic perisplenitis.

Pleural cavities show chronic adhesions over the left lower lobe and a persistent thymus.

Lungs, free of apical scars, were merely edematous. Lymph-nodes not enlarged.

Heart of normal size. Few sclerotic patches in the coronaries. Slight acute splenitis and fatty liver.

Brain: weight, 1115 gm. Dura slightly adherent and thickened. Recent fibrinous adhesions to pia. Subpial fluid opaque; convolutions flattened.

The *anatomical diagnosis* is given as a questionable acute cerebrospinal meningitis with persistent thymus and various chronic conditions, among which may be mentioned: chronic adhesive pleuritis; chronic tubercular lymphadenitis (mesenteric) with calcification; chronic adhesive perisplenitis.

The mass of lymph-nodes which formed the starting-point of the culture was the only manifest tubercular focus in the body. They were evidently enlarged and permeated with inconspicuous caseous foci. The method usual in this laboratory was resorted to with material of this kind. It was cut up and ground as much as possible in a sterile agate mortar with salt solution, and the turbid fluid injected into the peritoneal cavity of two guinea-pigs. Both became tuberculous, but only one was used for cultures. The method we have found most reliable for coaxing into active growth tubercle bacilli which are cultivated with difficulty is to put bits of tissue as large as peas, usually from the spleen, into Dorset's egg-medium, and after six to eight weeks to thoroughly spread the masses of growth as well as the original tissue over the surface of fresh egg and glycerin-agar tubes. This transfer is repeated until a fairly good growth is obtained on glycerin-agar, when the egg-medium is abandoned. The other medium most commonly employed—beef serum—is less certain and cultures may be lost. The best medium—dog serum—is obtained with difficulty, and therefore not used at present.

Inasmuch as the morphology of the tubercle bacillus is more or less influenced by the culture-medium used, only coagulated serum should be used for comparative studies. Upon glycerin-agar involution forms soon appear to complicate the morphological picture.

In the present case, after the third transfer on egg-medium, representing a total period of growth of over five months, a glycerin-agar culture was obtained from which a series of successful subcultures have been carried on. There are at present four tests which, taken together, enable us to classify mammalian bacilli into the human and the bovine types. These refer to:

(1) The form of the bacilli.

(2) The dysgenetic or eugenetic characters of the culture, according to the terminology employed by the Royal Commission of England.

(3) The relative virulence toward rabbits.

(4) The reaction curve in 5 per cent. glycerin bouillon.

Culture Human 25 was dysgenetic for the usual time, although at present, about eighteen months after isolation, it is nearly as vigorous as the human type. This strain was virulent for rabbits, as indicated in Table I, and in its reaction curve it corresponds closely to that of the bovine type, as shown in Table II. Concerning this table it should be stated that the cultures there given were chosen because they were prepared simultaneously from the same lot of bouillon, and were made in every respect under identical conditions.

HUMAN No. 26.—For the clinical history and the autopsy notes I am indebted to Dr. L. J. Rhea, of the Department of Pathology of the Harvard Medical School.

The case was that of an infant. Up to February, 1909, there had been no illness. At this time an acute, but slight, illness appeared, thought to be bronchitis. Since then the child was only comparatively well, but at no time actually ill. Temperature records are lacking. Death occurred in April after symptoms of acute nephritis. There was no source of the tubercular infection traceable to the immediate environment of the child.

The autopsy of this case is definite, and perhaps the *anatomical diagnosis* will be sufficient. Tuberculosis of the intestines and mesenteric lymph-nodes. Miliary tuberculosis of lungs, spleen, liver, and peritoneum; involvement of the bronchial glands.

Judging by the stage of the disease, the process was oldest in the intestine, where there was ulceration, and in the mesenteric lymph-nodes, which contained creamy areas of softening. In the other organs the lesions had not advanced beyond the small discrete or confluent grayish, somewhat translucent, tubercles.

The culture was isolated from a completely caseous, softened mesenteric lymph-node by passage through three guinea-pigs. Cultures were isolated from each guinea-pig, in the manner indicated above, and all but one strain discarded after a time. The feeble growth on glycerin-agar has continued up to the present, so that the reaction curve in glycerin bouillon has not yet been obtained, although the strain has been just one year under cultivation. Its virulence for rabbits is shown in Table I. Altogether the strain must be regarded as of bovine origin.

HUMAN NO. 27.—This strain has been under cultivation only a short time, but I venture to class it with the bovine type, because of its very short form and its high virulence for rabbits.

The clinical history of the case is as follows: A previously healthy baby girl had a convulsion when sixteen months old. The attack was preceded by a few days of malaise. The child recovered slowly, showing some weakness of the limbs on the left side. Ten days later there was a second convulsion, the child remaining in a more or less comatose state until death, about a month from the first symptoms. The signs pointed to a meningitis, and a probable diagnosis of tubercular meningitis was made. Lumbar puncture was performed, and 30 c.c. of clear fluid obtained. An examination of the cellular elements of this fluid showed a marked increase of lymphocytes (85 per cent.). The child died in a few days.

At autopsy the nodes, for which I am indebted to Professor E. E. Southard, were apparently quite negative, with the exception of the brain.

The *mesenteric lymph-nodes* were described as numerous, fairly large, and in part considerably injected, but no node showed caseation or other focal lesion. Smears from these glands, however, did show tubercle bacilli.

Pleural cavities free from adhesions. Lungs congested; possibly an early pneumonic process. Bronchial lymph-nodes not remarkable.

Tonsils not obtained. No lesion noted clinically.

The *brain* substance bulged on removal of the calvarium. A thick exudate containing numerous tubercles covered the base. The pia mater contained numerous miliary and conglomerate tubercles, having a rather characteristic vascular distribution. The prefrontal and the inferior parietal and occipital regions were freest of tubercles, the right inferior frontal being most involved.

Anatomical Diagnosis.—Acute edema and congestion of the lungs. Slightly injected mesenteric lymph-nodes. Tubercular meningitis.

The material from which the cultures were ultimately obtained was the spinal fluid withdrawn during life by lumbar puncture, and injected into the peritoneal cavity of two guinea-pigs. From these, cultures on egg-media were made in the usual way. The growth was very slow, but after about seven weeks colonies were distinct and a smear showed very short forms, not exceeding one micron in length.

As indicated in Table I, a rabbit was inoculated with one of the first cultures from a guinea-pig on egg-medium. At the date of the injection the growth was so feeble that in a smear from a suspension in normal salt solution only two clumps of bacilli were detected. A relatively large amount of this suspension was, therefore, injected into the peritoneal cavity at a venture. The rapid

death of the rabbit, the presence of myriads of tubercles on all peritoneal surfaces, and a well-advanced generalized embolic tuberculosis of the lungs demonstrated a high virulence for rabbits. We do not hesitate, therefore, to range this culture with the bovine type, although a study of it is only partly under way.

These three cases illustrate three different types of tuberculosis, all obscure as to diagnosis during life. In the first case—an adolescent—the local tuberculosis may have had either no immediate connection with the cause of death, or else the beginning of dissemination of the virus from the primary focus may have led to a reaction of the tuberculin type and to death. In the second case—an infant—the generalized tuberculosis, starting from the mesenteric lymph-nodes, was evidently not suspected, for the clinical history states that within the last week of life she had an acute illness of an indefinite type, which culminated in symptoms of acute nephritis. Here also the liberation of tubercle toxins may have been responsible for the acute nephritis.

In the third case—a child of seventeen months—the symptoms pointed to the central nervous system, and at one time a tentative diagnosis of anterior poliomyelitis was made.

In conclusion it should also be stated that no other similar cases have come under our observation during this period. They may be considered three consecutive cases as studied in this laboratory, all due to the bovine type of tubercle bacillus.

TABLE I.

Designation of Culture.	Total Age.	Number of Transfer.	Age of Culture Used in Days.	Dose in c.c. Injected into Vein of Ear.	No. of Rabbit.	Initial Weight.	Final Weight.	Result.	Remarks.
Human 25	9½ mos.	Sixth	35 days	0.5	382	1870 gm.	1280 gm.	Killed after thirty-nine days because animal dying.	Extensive tuberculosis of lungs, many minute tubercles in cortex of kidneys and wall of cecum and colon.
Human 26	4 mo.	Second	35 days	0.5	377	2130 gm.	2340 gm.	Killed in thirty-four days as dying in state of severe dyspnœa.	Many minute grayish tubercles in lungs, liver, spleen, and kidneys.
Human 27	20 days	First	20 days	3.0* (Abdomen)	368	?	2240 gm.	Died in thirty-three days.	Extensive tuberculosis of peritoneum and lungs. (Acute miliary tuberculosis.)

* Very dilute suspension.

TABLE II.

Bouillon, Composition of.	Designation of Culture.	Date of Inoculation.	Total Age of Culture.	Reaction of Bouillon in per cent. of a normal solution after: (—)=acid; (+)=alkaline.
Veal infusion, plus 1 per cent. peptone (Witte). 0.5 per cent. salt and 5 per cent. glycerin; reaction= —2.00; layer 1.5 cm. deep in 100 c.c. Erlenmeyer flask.	Human XXV	Nov. 19, 1909	11⅔ months	(*a*) 41 days=+0.5 (a) 80 days=—1.00* (*b*) 62 days +0.25 (b) 94 days —0.25
Veal infusion, plus 1 per cent. peptone (Witte) 0.5 per cent salt and 5 per cent. glycerin; reaction= —2.00; layer 1.5 cm. deep in 100 c.c. Erlenmeyer flask.	Bovine X	Nov. 19, 1909	18½ months	(*a*) 41 days=+0.12 (a) 94 days=—0.25 (*b*) 62 days +0.00 (b) 8 days —0.12
Veal infusion, plus 1 per cent. peptone (Witte), 0.5 per cent. salt and 5 per cent. glycerin; reaction= —2.00; layer 1.5 cm. deep in 100 c.c. Erlenmeyer flask.	Human†	Nov. 19, 1909	?	(*a*) 41 days=— .87 (a) 80 days=—2.75 (a) 137 days —2.95 (*b*) 63 days=—2.5 (b) 94 days=—3.25

* Contaminated with another bacillus.

† Culture submitted for test. Had been passed through a cow several years before. Originally isolated from human being.

THE REACTION CURVE OF THE HUMAN AND THE BOVINE TYPE OF THE TUBERCLE BACILLUS IN GLYCERIN BOUILLON

By Theobald Smith, M.D.

That there exist three readily distinguishable types of the tubercle bacillus may be regarded as a generally accepted fact today. To differentiate these types after isolation from cases of disease is a relatively simple matter for the bacteriologist. The interest which centers in the tubercle bacillus has, therefore, been shifted to certain problems springing from the recognition of these types. Are they fixed species or only races which in a certain environment may become transformed, one into the other, is perhaps the most important question upon which unanimity remains to be established. The existence of varieties within each type gives some standing to this question, and it has been approached experimentally by all those who have seriously studied the biology of the tubercle bacillus. In view of the uncertainties surrounding the fixity of the types now recognized, all methods for determining constant, even if minor, differential characters should be standardized and applied to the study of individual strains under varying conditions.

In several earlier publications, I described a culture method for distinguishing the bovine from the human type, which consists in determining from time to time, over a period of three to four months, the reaction of glycerin bouillon in which tubercle bacilli are growing. The curve resulting from such determinations can be plotted, and it presents certain characters which, under like conditions, remain fairly constant for each culture.

Several other investigators have taken the trouble to apply this method in their studies of tubercle bacilli from human and animal sources. Their results have impressed upon me the desirability of going over the method again and determining more precisely the conditions which make uniform results possible. I have, therefore, collated the new data obtained during the past three years, and I shall use these as a basis for the suggestions and comments which follow.

METHODS

My own experience has taught me the need of applying certain uniform methods in following the reaction curve. In the first place, the depth of the bouillon and the size of the flask should be the same for all comparative tests. Since the changes which take place in the bouillon are functions of the surface membrane, the deeper the layer of fluid, the more abundant is the food material, the more diffused the products, and the more limited the oxygen supply. If the flask is large, the surface of the fluid is correspondingly increased. This at first thought might seem to be of no consequence, as the ratio of the surface to the bulk of fluid remains a constant. It does, however, make some difference, because the tubercle bacilli starting to multiply at some one point on the surface require more time to cover the fluid in large flasks than in small ones. The membrane thus is older before the surface is covered, and retrogressive changes may start earlier. These considerations become important when we bear in mind that the reaction curve is a resultant of perhaps several different processes, which may either mutually neutralize or reënforce one another.

The amount of glycerin used also tends to modify the result. It is highly probable that in Erlenmeyer flasks with a layer of bouillon 1½ cm. deep nearly all strains of bacilli completely use up between 1 per cent. and 2 per cent. glycerin. To make conditions uniform the glycerin should be entirely consumed, or else a certain amount should remain unused. As we do not know what effect this residue may have on the bacilli when active growth has ceased, enough should be added to insure a good surplus. I have used 5 per cent. by volume, which amount allows a surplus in all cases. The initial reaction of the bouillon probably does not greatly influence the curve if the acidity be maintained within 1 to 2 per cent. of a normal acid. In my own recent tests it varied from 1.8 to 2.2 per cent. In all cases the bouillon was made from fresh beef or veal.

The flask used almost exclusively is an Erlenmeyer flask of Jena glass, of a capacity of 100 c.c., and containing a layer of glycerin bouillon 1½ cm. deep. The cotton plug was protected with a layer of tin-foil folded snugly around the neck. Inasmuch as we do not know what influence a freer supply of oxygen would have, the tin-foil should be used to make results comparable. Usually a number of flasks were prepared at the same time, so that each flask was opened but once or twice for the withdrawal of fluid for titration.

Great care must be exercised not to use figures obtained by titrating fluids from contaminated flasks. The faintest cloudiness of the fluid is suspicious. Even with a limpid fluid, fungi may exist in the membrane. In all such cases

the reaction may be abnormal, for many saprophytes act upon glycerin with the production of acids.*

THE REACTION CURVE

During the past three years the procedure outlined above has been used quite uniformly in the study of old and recent cultures isolated in this laboratory from a variety of sources, and whose history was therefore definitely known. The results are plotted in Figs. I to V. (See pp. 369-372.) Each series of flasks prepared at the same time is indicated by the same sign. Sometimes the sign refers to a second titration of the same flask, sometimes to duplicate flasks. In all cases the degree of acidity or alkalinity is expressed in per cent. of a normal solution.

In Fig. I are plotted the results of titration of a single strain, Human No. 24. The curve has been drawn arbitrarily to indicate the general direction which the alkaline and the acid movement takes. In this strain, under the defined conditions, the reaction rose above the neutral point in some series. It fell rapidly, and the fluid reached its maximum acidity within forty days.

In Fig. II are plotted the titrations of another human strain, Human No. 12. The curve in general is like that of Human No. 24, but somewhat steeper. This strain has always been characterized as a rapid acid producer. The neutral point is not reached, and the fall to the lowest acid level is very abrupt, occurring within twenty-five days.

In Fig. III are plotted the tests of one other human culture, No. 6. This resembles No. 12 in so far as neither reaches the neutral point.

In Fig. IV are plotted the tests of four bovine strains which had been under cultivation from one to fifteen years. The resulting graph is quite different from those already described. The reaction not only ascends to and above the neutral point, but it remains above, with rare exceptions, for sixty days or longer. Then there is a gradual descent of the curve, which may fall to a level of 0.5 to 1.5 per cent. normal acidity after three to four months.

Fig. V* represents four cultures (three human and one horse culture) which, according to all other criteria, should be classed with the bovine type. The resulting curve is almost identical with that of the bovine cultures themselves.

* In all cases phenolphthalein was used as an indicator as heretofore, and $\frac{N}{20}$ solutions of NaHO and HCl used for titration. Five cubic centimeters of culture fluid in 45 c.c. of distilled water were boiled for a minute in an evaporating dish and titrated while hot. As soon as a faint pink color appeared, the process was stopped. When the fluid became cool, the tint was usually much stronger. Uniformity of tint in the different dishes was attained by adding, if necessary, one or more drops of either acid or alkaline solution.

In former publications it was stated that cultures of the bovine type become faintly acid, neutral, or alkaline, and remain so. This is not wholly true with the new procedure described above, as the graphs show. After sixty days the bovine cultures fall gradually below the neutral level, and some may even reach an acidity of 1.5 per cent. of a normal solution. The gap between the human and the bovine type remains the same, for the former likewise produces more acid in thin layers. The slight discrepancies between these and earlier results are due to the fact that larger flasks and deeper layers were employed at first.

Having now defined the two types of reaction curves, I will consider the results obtained by others. O. Bang[2] tried the author's method upon twelve strains of the avian tubercle bacillus, using four human and one bovine culture as controls. He fully confirms the results of the writer, and finds, furthermore, that the avian bacillus has the same reaction curve as the bovine bacillus.

Perhaps the most exhaustive trial of the method was given by A. L. Griffith. Griffith[3] used 500 c.c. flasks containing 200 c.c. of bouillon. This amount I find gives a depth of about 3 cm. He also used chiefly 2 per cent. glycerin. He concludes that the differences he observed are differences in degree, and not in kind. He also says: "My observations therefore clearly show that glycerin broth does not differentiate tubercle bacilli into two classes, and yield no evidence that there is an essential difference in the action of different strains of tubercle bacilli on glycerin." Griffith furthermore claims that the two curves gradually shade into one another, and that from the greatest acid producer to the least an unbroken series may be constructed.

If we take into consideration individual titrations, the strictures of Griffith have considerable weight. Thus after four months the end-reaction of Human No. 15 in some series of flasks did not differ appreciably from that of several bovine cultures in other series of flasks, but if we follow the two strains under precisely the same conditions, we find decided differences.

Mohler and Washburn,[4] after a more or less exhaustive trial, are inclined to agree with the writer as to the existence of two types of curves. They also examined a number of cultures from animals of a zoölogical park in glycerin bouillon, and their results indicate aberrant curves in so far as they conform neither to the bovine nor the human type, but appear midway.

Duval[5] describes a culture from man which at first yielded a high acid reaction, but after two years completely changed its reaction curve. The fluid thereafter became alkaline.

* In this figure the circle stands for Human No. 11, the circle with vertical bar for No. 19, the circle with the horizontal bar for No. 25, and the circle with both bars for Horse Culture No. 1. These numbers correspond to cultures described in former papers by the writer.

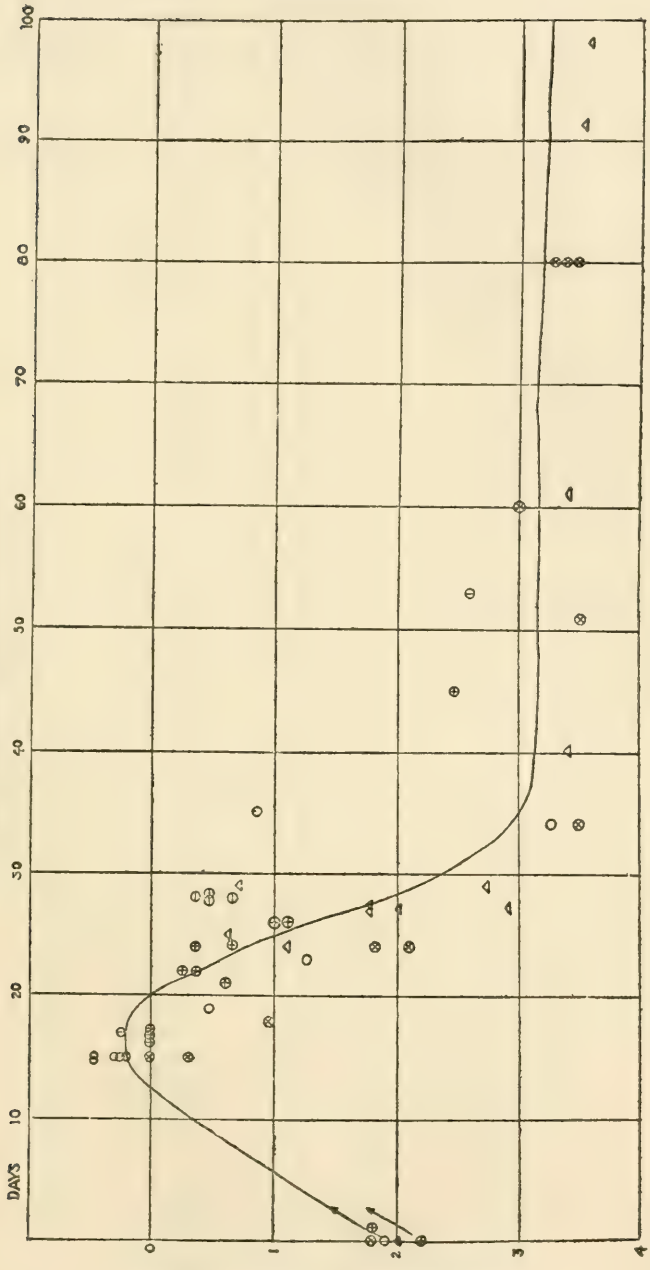

FIG. I.—Human tubercle bacillus No. 24.

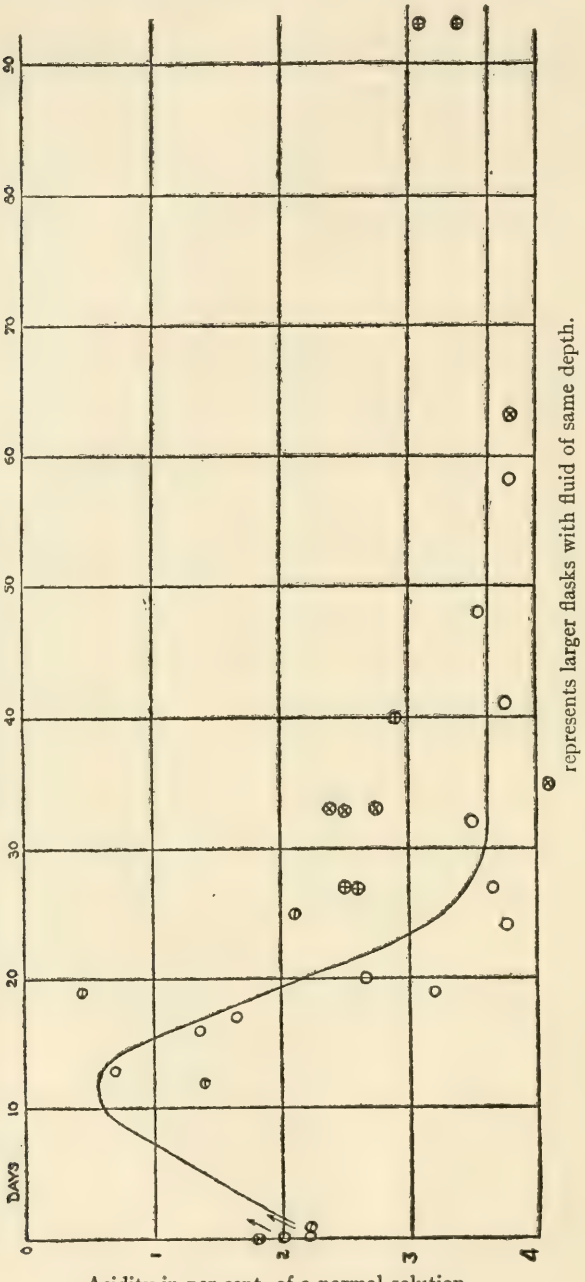

FIG. II.—Human tubercle bacillus No. 12.

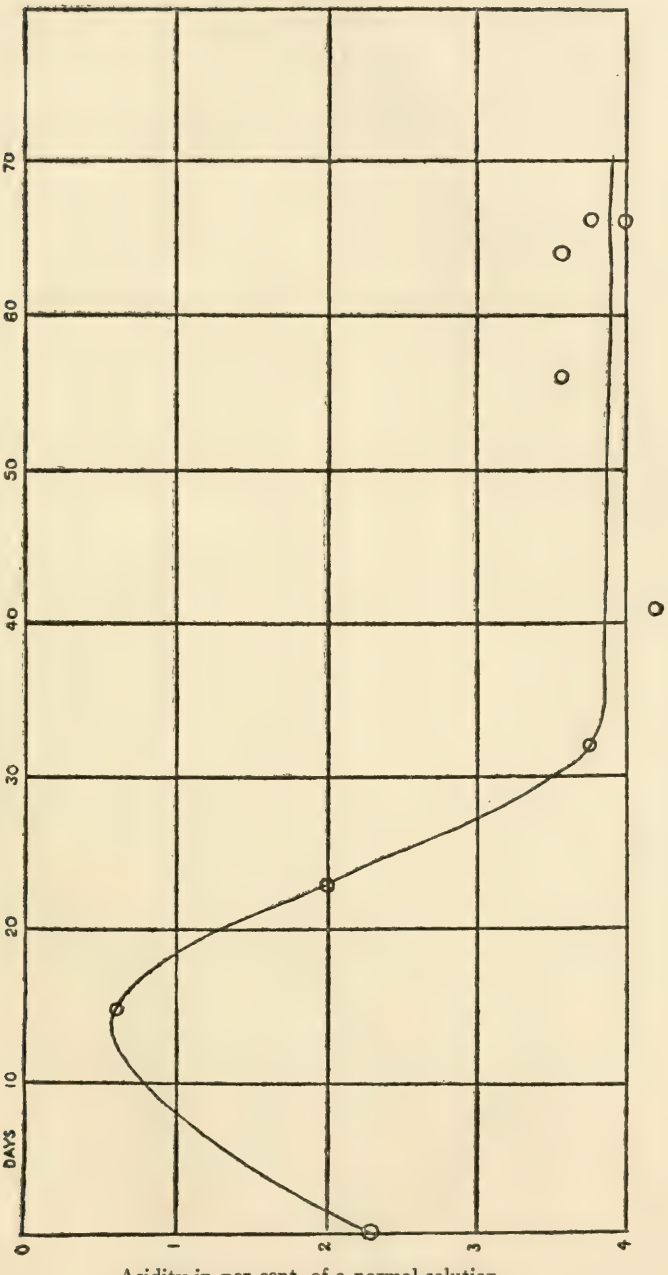

FIG. III.—Human tubercle bacillus No. 6

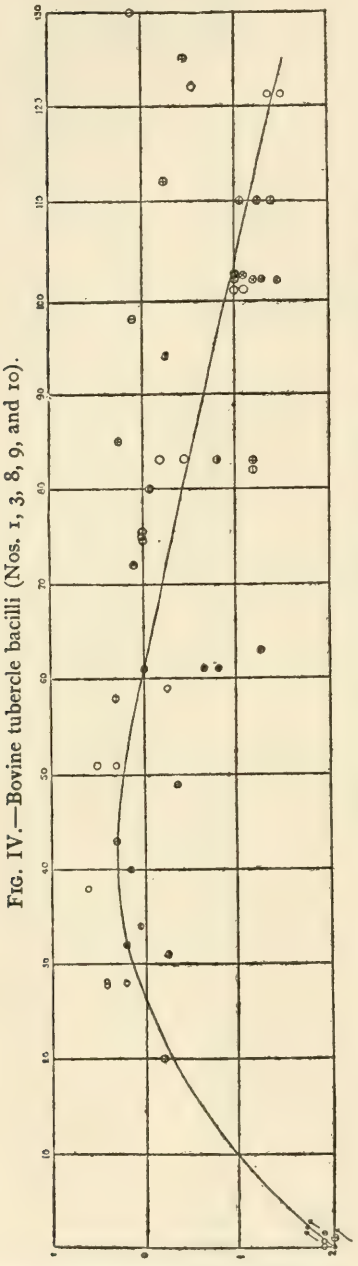

FIG. IV.—Bovine tubercle bacilli (Nos. 1, 3, 8, 9, and 10).

Acidity in per cent. of a normal solution.

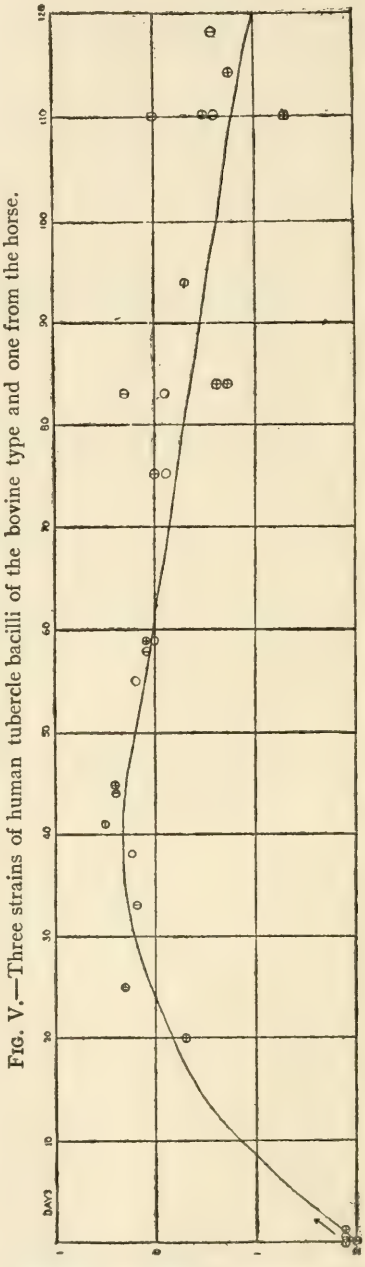

FIG. V.—Three strains of human tubercle bacilli of the bovine type and one from the horse.

Acidity in per cent. of a normal solution.

Lewis[6] found one human culture possessing the virulence of the bovine type, which yielded a moderately acid end-reaction, and one culture having the low virulence of the human type, which yielded an alkaline end-reaction. Similarly a culture sent to me by Dr. M. P. Ravenel about seven years ago, which was tested at that time, simulated the bovine type of curve.

The nature of the changes which go on in the culture fluid and which tend at first to the production of alkaline and later of acid products remains at present a subject for speculation. In the earlier communications I likened the reaction to that of the colon and paratyphoid bacilli, which, in the presence of a small amount of dextrose (or other fermentescible sugar), such as 0.1 to 0.3 per cent., produce a final alkaline reaction in the open arm or bulb of the fermentation tube, and an acid reaction in the closed arm. This difference is due to the fact that two processes are going on at the same time—one which splits the sugar and produces acids and one associated with the growth or multiplication of the bacteria themselves, which is accompanied by alkali production. The latter process goes on only in the open bulb in the presence of oxygen, the former under both aërobic and anaërobic conditions. In the open bulb the process of active growth soon neutralizes the acid formed there. In the closed branch acid only is formed, and this remains intact, since growth is very feeble there. If, in place of 0.1 to 0.3 per cent. dextrose we use 0.5 to 1 per cent., the end-result is different. The bacilli rapidly produce acid, the alkali production is inhibited, and after a few days both open and closed arms contain fluid of a high acid reaction, the degree of acidity depending on the acid endurance of the culture used. With the rapid formation of acid active multiplication ceases and the bacilli are gradually destroyed.

Applying this phenomenon to the tubercle bacillus, I assumed that at first the rapidly growing bacilli produced more alkali than acid, the latter being neutralized and used up. When the fluid became covered with a membrane, or even when the still incomplete membrane became quite thick, as is usually the case with the human type of bacilli, the tendency to produce alkali became less, and that to produce acid more, owing to the partly anaërobic conditions produced in the thickening membrane. Hence the production of acids would prevail toward the latter period because growth was inhibited.

Duval assumed, on the evidence furnished by certain experiments, that the acid production is due to autolytic processes following the death and disintegration of bacilli which act on the glycerin molecule. This view he bases on the fact observed by him that acid bodies are set free after tubercle bacilli had been killed by heat. A priori there are certain facts favoring Duval's view, for tubercle bacilli are mostly dead after three months—at least, incapable

of yielding subcultures. When the destruction begins and how rapidly it progresses has not been worked out. It seemed to me worth while to make some tests of Duval's theory, and I have, therefore, adjusted the experiments to the hypothesis that some surviving ferment acts upon the glycerin. In order to test this view from different sides I varied the experiments in many ways, using a single strain of tubercle bacilli.

1. Flasks of 5 per cent. glycerin bouillon containing complete membranes of tubercle bacilli and at different stages of the downward movement toward the final acidity were heated at 100°, 90°, 80°, and 60° C., and placed either in the incubator or refrigerator.

2. Similar flasks were treated by removing the glycerin bouillon and substituting water, normal salt solution, and 5 per cent. glycerin water, leaving the membrane intact.

3. The same experiment was repeated by using the same media plus chloroform to check any further growth in the membrane.

4. Chloroform was added to cultures, and the latter replaced in the incubator.

5. Fresh glycerin bouillon was substituted for that in the culture, leaving the membrane intact; also portions of membrane were transferred to the old bouillon in fresh flasks.

6. The bouillon removed from the membrane was kept under observation in the incubator, with or without chloroform.

It is needless to go into details concerning these numerous, time-consuming experiments. The results may be briefly told. Wherever growth was definitely checked by chloroform or heat and the culture remained free from outside contamination, the change in reaction was usually in the direction of a higher acidity. This change was slight—from 0 to 0.8 per cent. ad maximum. At the termination of the test, usually from two to three months after the treatment of the culture by heat or otherwise, the bacillary mass was collected and subjected to centrifugal action to determine the amount. The control cultures which were left to finish their growth contained, as a rule, twice as much bacillary deposit as those heated or chloroformed or exposed to water, salt solution, etc. The amount of acid production in them was, however, five to seven times as great as that which took place after the cultures had been checked.

So far these studies have been concentrated upon strain designated Human No. 24. Perhaps the examination of other human cultures may yield different results. The culture selected presents, however, the typical human curve, and I am inclined to believe that results obtained with others will not depart

materially from those here given. I am, therefore, not inclined to accept the hypothesis that the second part of the reaction curve is wholly a result of autolytic processes, but I am still of the opinion that it is largely associated with processes going on during the life of the culture, and that only a little acid is contributed by processes of disintegration. This view is supported by Siebert,[7] who in a recent article finds that if the acid formed be neutralized with sodium hydroxid or marble, the former being the most efficient, the total growth is thereby increased. If the acid production were wholly of post-mortem origin, its neutralization could hardly be expected to revive a portion of the bacilli to such renewed activity. It is, on the other hand, well known that the accumulation of acid products resulting from carbohydrate fermenta-

TABLE I

(+ = *alkaline*; — = *acid*)

Designation of Strain.	Total Age.	Per Cent. Glycerin. (Vol.)	Age of Culture.	Reaction. (Per Cent. of Normal Acid.)	Age of Culture.	Reaction. (Per Cent. of Normal Acid.)
Bovine No. 1..	14½ years.	1	85 days.	+0.37	112	+0.05
		2	85 days.	+0.3	112	+0.2
		4	85 days.	+0.25	112	—0.25
Bovine No. 8..	10 years.	1	..	..	102	—0.68*
		2	..	..	102	—0.05
		4	..	..	102	—0.4
Human No. 10.	7½ years.	1	..	..	96	—0.25
		2	..	..	112	—0.8
		4	..	..	112	—2.5
Human No. 15.	6 years.	1	82 days.	0.0	113	—0.15
		2	82 days.	—0.2	113	—0.4
		4	82 days.	—1.3	113	—1.6
Human No. 24.	3½ years.	1	96 days.	—0.57	123	—0.62
		2	96 days.	—3.0	123	—2.9
		4	96 days.	—3.4	123	—3.5

tion of living bacteria checks the further development of many bacteria in cultures and eventually kills them. We also know that different kinds of bacteria, or even different strains of the same species, produce slightly but constantly different amounts of acid, probably because they possess varying degrees of sensitiveness to the accumulating acid product. This same phe-

*In this flask only a small patch formed, hence the reaction did not reach the neutral point. This figure is, therefore, on the upward, not the downward, movement of the curve.

TABLE II

Designation of Strain.	Total Age.	Per Cent. Glycerin. (Vol.)	Age of Culture. (Days.)	Final Reaction.	Total Growth. (c.c.)
Bovine No. 1.....	15½ years.	1	81	+0.05	1.75
		2	81	—0.1	2.7
		4	81	—0.2	4.0
Bovine No. 8.....	10¾ years.	1	85	—0.06	1.45
		2	85	—0.69	2.9
		4	85	—1.9	2.7
Bovine No. 10....	2 years.	1	53	+0.2	1.35*
		2	53	+0.06	1.3*
		4	53	—0.2	1.3*
Human No. 10....	8 years.	1	79	—0.3	1.6
		2	79	—2.25	1.9
		4	79	—3.7	2.0
Human No. 15....	6½ years.	1	83	—0.4	1.8
		2	83	—0.65	2.4
		4	83	—2.9	3.0
Human No. 24....	4 years.	1	77	—0.25	1.7
		2	77	—2.4	2.3
		4	77	—3.6	2.4

nomenon occurs among strains of human tubercle bacilli, for certain ones always produce more acid than others under the same conditions. In other words, tubercle bacilli are individualized in this regard. Thus the strain designated Human No. 15 has always produced less acid than Human No. 12.

That two processes, a rapid fermentative and a later disintegrative, may be associated in the reaction curve is supported by the data found in Tables I and II. The experiments here recorded were made to repeat earlier tests with different amounts of glycerin upon both types of varying ages. The experiment of Table I was performed in 1909; that of Table II is just concluded. In the first place, the early statement made by me that in bouillon containing small amounts, say up to 1 per cent., of glycerin, tubercle bacilli tend to produce an alkaline reaction, is here confirmed. The final slightly acid reaction in 1 per cent. glycerin bouillon is perhaps due to disintegrative processes. The striking difference in the reaction of 1 and 4 per cent. glycerin bouillon in the human type after three months is probably due to acid production in glycerin not used up in the growth of bacilli. Under the conditions

*In these flasks growth had ceased at this time and the membranes had partially or wholly subsided.

and with the amount of peptone, etc., supplied, it is evident from the tables that 1.5 to 2 per cent. glycerin represents the average amount utilizable. With increased amounts of peptone, etc., and the neutralization of the acids formed, more glycerin may perhaps be consumed.

The bovine cultures in Table I act alike. In Table II there is considerable variation. Thus Bovine No. 1, cultivated for over fifteen years, still maintains the characteristic reaction. Bovine No. 8, which produced little acid in Table I, produced here much more—in fact, the highest amount I have ever recorded. Bovine No. 10, a younger strain, grew more feebly and maintained the reactions of the bovine type. It is possible that the oxygen supply is the cause of these differences, and this is now under investigation.

In order to examine into the statement of Griffith that the degree of acid production is a function of the amount of growth, rather than of type, the bacilli from the various flasks in Table II were centrifugalized and the amounts recorded in cubic centimeters in the last column. Ordinary graduated centrifuge tubes were used, and the bacillary masses were broken up a second time with glass rods after the centrifuge had been running fifteen to twenty minutes. They were then subjected again to centrifugation for twenty minutes at a speed of about 3000 revolutions per minute, and the deposit read off at once. If the reading is delayed, the bulk increases by a loosening up of the upper layers, and errors may thus creep into the readings. The figures show that the relation of acidity to bulk is by no means a definite and uniform one. Thus in Bovine No. 1 the reaction of three flasks differed but little, yet the bulk of bacilli is evidently dependent on the amount of glycerin present. Where acids are produced, the bulk of growth does not seem to increase beyond a certain point with the amount of glycerin, probably because the acids are inhibitory. This is shown by Human No. 10 and No. 24 in Table II, where the bulk of growth in 2 per cent. glycerin nearly equals that in 4 per cent. The slight increase in acidity due to disintegrative changes is shown in Table I under Bovine No. 1, where the flask containing 4 per cent. glycerin shifts from + 0.25 per cent. alkalinity on the eighty-fifth day to —0.25 per cent. acidity on the one hundred and twelfth day. Similar changes are noticeable under Human No. 15.

In these two tables the different behavior of the same strains in two different lots of bouillon is well illustrated. In general more acid was produced in the second experiment. Bovine No. 8 practically failed to grow in 1 per cent. glycerin bouillon in the first series. In the second it grew very well.

Both tables finally prove that 2 per cent. glycerin in bouillon is not sufficient

to bring out the differences between the bovine and the human type in all strains. Comparison of Human No. 15 and No. 24 illustrates this fact.

In order to determine the behavior of the two types in the presence of dextrose the following experiment was carried out: To ordinary acid bouillon 2 per cent. dextrose was added and the fluid autoclaved. This, together with the same bouillon containing neither dextrose nor glycerin, was inoculated with four different strains and incubated. The conditions as regards size of flask, depth of fluid, tin-foil covering, etc., were the same as in the experiments reported above. After two months the various flasks were titrated. The results are presented in the following table:

TABLE III

Designation of Culture.	Culture-medium.	Membrane after Two Months in Per Cent. of Surface Covered.	Reaction (—=Acid +=Alkali).	Deposit after Centrifugation (c.c.).	Remarks. The Original Acidity of Acid Bouillon =—2.2. The Original Acidity of Dextrose Bouillon =—2.4.
Bovine No. 1 ..	Acid bouillon.	5 per cent. covered.	+0.1	..	..
	Acid bouillon +dextrose.	Complete.	+0.25	1-0	About 10 per cent. of membrane thick, the rest very thin.
Human No. 10.	Acid bouillon.	20 per cent. covered.	±0.0	..	..
	Acid bouillon +dextrose.	Complete.	+0.35	1.5	Membrane thick.
Human No. 15.	Acid bouillon.	5 per cent. covered.	—0.3	..	..
	Acid bouillon +dextrose.	40 per cent. covered.	—0.1	0.55	..
Human No. 24.	Acid bouillon.	5 per cent. covered.	—0.35	..	..
	Acid bouillon +dextrose.	Complete.	+0.35	1.1	Membrane thick.

It will be noted that in the flasks containing the acid bouillon without either dextrose or glycerin only a slight multiplication took place. In the flasks containing dextrose, three had a complete membrane. Those of Human Nos. 10 and 24 were complete and fairly thick, that of Bovine No. 1 feeble, with local thickenings. Not quite one-half of the surface became covered in Human No. 15. Turning to the reaction, we note that even in those flasks containing no dextrose the reaction is at or near the neutral point. In those

with dextrose the reaction has been carried beyond the neutral point, except in the feebler growth of Human No. 15.

The dextrose is probably not split into acids which pass into the fluid before being utilized, as is the case with glycerin in the presence of the human type of tubercle bacilli. It is, however, to a certain degree utilizable, although inferior to glycerin in this respect, as the results of centrifugalizing the bacilli show when compared with those on Table II, where the yield is about twice as great with 2 per cent. glycerin.

Similar trials with glucose as a substitute for glycerin were made by Griffith. My results accord with his in respect to the movement of the reaction. I cannot, however, agree with him that "glucose is a very satisfactory substitute for glycerin"—certainly not for all cultures.

After the experiment had been closed the bouillon from flasks of Human Nos. 10 and 24 originally containing dextrose was mixed with fermented bouillon in definite proportions, and subjected to fermentation with Bacillus coli in the fermentation tube. Compared with a control the tubes containing fluid from flask of Human No. 10 showed no remaining dextrose, whereas those from flask of Human No. 24 indicated that nearly one-half had disappeared.

The question toward which nearly all these data tend is whether the processes indicated by the reaction curves of the two types of bacilli are qualitatively identical or not. In a former communication I endeavored to explain the differences in the reaction curves by assuming that the bovine bacillus utilized the glycerin without splitting it into acids, whereas the human type first split it into acids. This explanation was not accepted by Griffith nor by Siebert, who regard the behavior of both types toward glycerin as the same. That this behavior is not identical is evident from the data I have presented, but whether it is variable, inconstant, and the resultant of essentially the same functional activities of the two types cannot be determined until much more work has been done. When cultures have been recently isolated, the differences in behavior of the two types is striking. With the continued artificial cultivation the bovine strains grow more abundantly and the reaction after two to three months becomes acid. Within this period the difference between the bovine and the human type is marked even in old cultures. After three months the culture fluid of many bovine strains is from 0.5 to 1.5 per cent. acid. It still remains to be determined whether this acidity, coming on so late, is not wholly to be ascribed to disintegrative changes. If so, the original distinction made by me will stand until overthrown by more thorough analytic studies than have been made up to the present.

The existence of strains of bacilli which do not fit either the bovine or the human type has been pointed out by Duval[5] and by Lewis.[6] In these relatively rare strains a high degree of virulence is associated with the human type of reaction curve, or a low degree of virulence with the bovine type of curve. The more thorough continued study of these aberrant forms becomes of importance in view of the want of unanimity which exists at present toward the doctrine of the stability of the three types. As I have previously stated, strains of tubercle bacilli are more or less individualized, and those found in species other than man and cattle should receive more thorough attention in order that light may perhaps be shed upon the degree of plasticity of the well-established types. It should also be borne in mind that degenerative changes may simulate adaptive characters and lead us astray.*

In conclusion, I may say that the reaction curve of tubercle bacilli in glycerin bouillon has proved of great value to me in studies of tubercle bacilli. Among the criteria for distinguishing the bovine and human type of bacilli, such as slow or rapid growth, high or low virulence for rabbits, I regard the difference in the reaction curve as the most interesting and at the same time the most puzzling phenomenon. It is closely bound up with vital processes of these species, of which we know as yet very little. All claims of transformation by passages of the human into the bovine type or vice versa must, in my estimation, pass the test of the reaction curve as well as the others given above before such transformations can be accepted as accomplished facts.

LITERATURE

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2. Centralbl. f. Bakt., Erste Abth., 1906, xliii, 34.
3. Second Interim Rep. Royal Commission on Human and Animal Tuberculosis, Pt. iv, Appendix, iii, 55.
4. Bureau of Animal Industry, Bulletin No. 96, p. 78, Washington, D. C.
5. Jour. Exper. Med., 1909, xi, 403.
6. Ibid., 1910, xii, 82.
7. Centralbl. f. Bakt., Erste Abth., 1909, li, 305.

DISCUSSION ON PAPERS BY DR. FABYAN AND DR. SMITH

Dr. W. H. Park: I would like to ask Dr. Smith what explanation he would give of my observation that two out of twelve human cultures, in which the curve, according to Dr. Smith's method, had been worked out, followed the bovine curve. I realize that a great majority of human strains will show the typical Theobald Smith curve, but about 10 per cent. of such human strains will show the bovine curve. How does Dr. Smith explain these cases? In my own

* A good illustration is found in certain biologically and morphologically true diphtheria bacilli, which produce no toxin whatever.

observation, I would say that all bovine strains will always give the typical bovine curve.

Dr. W. C. White: I would like to ask Dr. Smith if anything has been done to determine the cause of the variations in the amount of growth in higher percentages of glycerin. What explanation does Dr. Smith give for the very large variation in the amount of growth of bovine cultures as compared with human cultures on varying percentages of glycerin.

Dr. Theobald Smith: The great increase in acidity is inhibitory to the growth of human bacilli, which accounts for the same result with 2 and 4 per cent. of glycerin. In certain bovine cultures there is not enough acidity developed to produce this inhibition, and growth goes on. Replying to Dr. Park, I do not know what these curves mean, and the object of my paper was to point to the need for further study to discover the meaning of these aberrant curves.

Dr. H. G. Beyer: Was there any determination of the chemical nature of the acid concerned in the production of this curve?

Dr. W. H. Park: Is not Duval's experience in the sudden change of character from human to bovine in a culture very exceptional, and may it not perhaps be explained by an accidental contamination of the culture? The experience is certainly at variance with that of all other observers.

Dr. Smith: We are now trying to determine the character of the acids, but no conclusions have been reached. I will say, in answer to Dr. Park, that I had thought that there might have been an accidental contamination of Dr. Duval's culture. So many things may happen in experimental work of this kind that it seems best to wait for further evidence before denying the possibility of some such transition from one type to another.

Dr. Marion Dorset: I should like to ask Dr. Smith if he had considered the mineral salts in connection with the production of this acid, and especially has he considered the phosphates?

Dr. Smith: We attempted a study of the phosphates in this connection, but arrived at no conclusion. The work proved to be too extensive to eliminate all variations, and had to be abandoned for the present.

National Association for the Study and Prevention of Tuberculosis

CONSTITUTION AND BY-LAWS

LIST OF MEMBERS

January 1, 1911

CONSTITUTION AND BY-LAWS

CONSTITUTION

Article I.—Name

The name of this Society shall be The National Association for the Study and Prevention of Tuberculosis.

Article II.—Objects

The objects of the Association shall be: (*a*) The study of tuberculosis in all its forms and relations; (*b*) the dissemination of knowledge concerning the causes, treatment, and prevention of tuberculosis; (*c*) the encouragement of the prevention and scientific treatment of tuberculosis.

Article III.—Meetings

The meetings shall be held at such times and in such places as may be directed under the By-Laws.

BY-LAWS

Article I.—Membership

This Association shall consist of three classes of members: (*a*) Members; (*b*) Life Members; (*c*) Honorary Members.

(*a*) Those persons who participated in the organization of the Association at the meeting in Philadelphia on March 28th, 1904, and such persons as shall from time to time be elected by the Board of Directors shall be Members so long as they comply with the provisions of the By-Laws. The dues of Members shall be Five Dollars ($5) a year.

(*b*) Members may become Life Members upon the payment of Two Hundred Dollars ($200).

(*c*) Persons distinguished for original researches relating to tuberculosis, or eminent as sanitarians, or as philanthropists who have given material aid in the Study and Prevention of Tuberculosis may be elected Honorary Members.

Article II.—Board of Directors

Section 1. The Association shall, at its first meeting, elect a board of thirty directors, divided into five groups of six each, to serve one, two, three, four, and five years, the duration of office to be determined by lot; thereafter, retiring directors, who have served a full term of five years, shall not be eligible for reëlection the year of retirement; provided, however, that this restriction shall not apply to the secretary or treasurer.

The Board of Directors may hereafter, at the annual meeting or at a special meeting of the Association, be increased to at least sixty, the additional members to be divided into groups in accordance with the provisions of the preceding paragraph of this section and subject to the same restrictions. It is furthermore provided that at least one-third of the total membership of the Board shall consist of laymen. At annual meetings succeeding the increase of the Board of Directors to a membership of sixty, twelve directors shall be elected for terms of five years, or, in case of vacancies in any of the groups, for such unexpired terms.

Section 2. The Board of Directors shall make its own rules; the government of the Association, the planning of work, the arrangement for meetings and congresses, and all other matters appertaining to legislation and direction shall be in its hands; committees shall have the power to execute only what is directed by the Board.

Article III.—Election of Officers

The Board of Directors shall annually elect from its own number a President, two Vice-Presidents, a Secretary, and a Treasurer, who shall be the officers of the Association as well as of the Board.

Article IV.—Committees

Section 1. The Board of Directors shall appoint an Executive Committee of seven directors, of which the President and the Secretary shall be members *ex officio*, to which shall be entrusted all the executive work of the Association.

SECTION 2. The Board of Directors is empowered to appoint representatives on the International Committee on Tuberculosis; it shall also from time to time appoint such committees as may be necessary for scientific and educational work, and for the holding of meetings and congresses.

ARTICLE V.—QUORUM

Seven Directors shall constitute a quorum of the Board of Directors.

ARTICLE VI.—MEETINGS

There shall be at least one stated annual meeting of the Association at a time and place to be fixed by the Board of Directors. Other meetings of the Association may be called by the Board at such times as it shall deem proper. The Executive Committee shall hold stated and other meetings as may be directed by the rules of the Board of Directors.

ARTICLE VII.—MONEYS

The moneys received from membership dues and from all other sources shall be used for defraying the expenses of the Association, and for furthering its objects under the direction of the Board of Directors.

ARTICLE VIII.—AMENDMENT OF CONSTITUTION

Propositions to amend the Constitution may be presented in writing at any meeting of the Board of Directors or of the Association; they shall be then referred to the Board of Directors for consideration and report. The Board of Directors shall report all propositions for amendment, whether submitted to it originally or by reference, at the meeting of the Association next following, when action may be taken; *provided, however*, that no proposition for amendment shall be voted upon within thirty days after its presentation, or without at least twenty days' notice of the meeting at which it is to come up for consideration, which notice shall set forth the proposed amendment in full. An affirmative vote of two-thirds the members present shall be required for adoption.

ARTICLE IX.—AMENDMENT OF BY-LAWS

By-Laws may be amended in the same manner as the Constitution or by a two-thirds vote of the members present at a meeting of the Board of Directors, provided that in the latter case the proposition to amend has been presented in writing at a previous meeting of the Association, or of the Board

of Directors, and that subsequently to such presentation twenty days' notice in writing has been given of the proposed amendment in the call for the meeting.

Article X.—Advisory Council

The Advisory Council of the National Association for the Study and Prevention of Tuberculosis shall consist of:

First. Directors of the Association.

Second. Officers or representatives appointed by various recognized State associations for the prevention of tuberculosis, such representatives being required to qualify as members of the National Association, the number in any case not to exceed five.

Third. Officers or representatives of various recognized local or municipal associations for the prevention of tuberculosis, such representatives being required to qualify as members of the National Association, the number in any case not to exceed three.

Fourth. A member of the medical staff of every public hospital or sanatorium for the exclusive care of tuberculous patients, such member to be designated by the board of trustees or other authorities of the hospital or sanatorium, such representative being required to qualify as a member of the National Association.

Fifth. A representative from the board of trustees or other executive authorities of approved hospitals or sanatoria for the exclusive care of tuberculous patients, such representative being required to qualify as a member of the National Association.

Sixth. Representatives of recognized, incorporated charitable societies or associations, such representatives being required to qualify as members of the National Association, the number in any case not to exceed three.

Seventh. The president or medical officer of the Health Department of any State or any city with a population of more than twenty thousand may become *ex officio* a member of the Advisory Council during his term of office.

The Advisory Council shall meet at the time of the annual meeting of the Association, and at such other times as it may be called together by the Directors or the President of the National Association. During the meetings of the National Association the Advisory Council shall have regular stated meetings at which members of the Council may bring up for discussion, or may present papers, which have been approved, bearing on the administrative control of tuberculosis, the management of hospitals and sanatoria, may make recommendations to the Board of Directors with regard to the conduct of the National Association, and other related subjects.

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